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EVALUATION OF GROOVED SOLID LUBRICATED BEARINGS

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FUELS AND LUBRICATION DIVISION*

FEBRUARY 1976

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TECHNICAL REPORT THRU JULY 1975

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AIR FORCE AERO-PROPULSION LABORATORY
AIR FORCE WRIGHT AERONAUTICAL LABORATORIES
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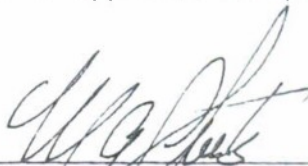
This report contains the results of an effort to investigate the performance of solid lubricated ball bearings under high speed conditions. The work was performed in the Fuels and Lubrication Division of the Air Force Aero Propulsion Laboratory, Air Force Wright Aeronautical Laboratories, Air Force Systems Command, Wright-Patterson AFB, Ohio, under Project 3048, Task 304806 and Work Unit 30480619. The effort was conducted by Mr. Mac A. Sheets/SFL and Mr. Ronald D. Dayton/SFL during the period July 72 to June 75.

Acknowledgement is hereby given to Mr. C. W. Smiley and Mr. S. R. Jackson for the conduct of the reported tests and for their otherwise very generous support to this program; to Mr. D. B. Elkins who balanced the solid lubricated bearing retainers and test rig drive shaft, and to various members of the AFAPL Zone Shop (LGUZA) who supported our effort through the fabrication and modification of various required items.

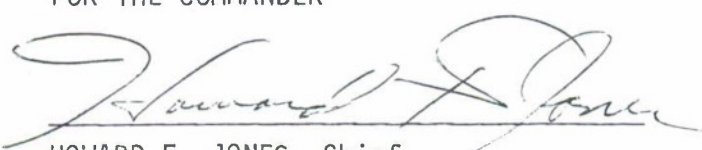
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This technical report has been reviewed and is approved for publication.


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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report describes an evaluation of solid lubricated bearings having grooved inner races. The intent of these grooves was to pump ambient air into the bearing, thus lowering stabilized operating temperatures and providing a means of heat dissipation. Nineteen series of tests were run with grooved and ungrooved bearings over a range of bearing loads and speeds. Bearing stabilization temperature and torque were monitored at each load-speed operating condition. Speeds were varied between 7500 and 30,000 RPM. Axial loads ranged		

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between 75 and 150 pounds. Radial loads varied from zero to 75 pounds. Solid lubrication was provided using retainers of either a silver-mercury-teflon-molybdenum diselenide composite or a gallium-indium-tungsten diselenide compact. Bearing cage unbalance problems prevented a determination of groove effectiveness relative to cooler bearing operation. Speed had a predominant effect on bearing operating temperature and torque. The effects of bearing load and cage material were considerably less.

In addition, five duration tests were conducted at 40,000 RPM. A bearing life of 14.5 hours was achieved at this speed with an axial load of 100 pounds.

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INTRODUCTION

Solid lubricated bearings offer potential for use in a wide range of applications where reduced maintenance is desired or operating and environmental conditions are such that conventional lubricants cannot be used satisfactorily. Both of these major considerations are pertinent where aerospace applications are concerned. Self lubricating bearings are of a sacrificial nature in that the lubricant is gradually depleted during usage. Their greatest potential is seen to be in those applications which have limited operating life requirements. These would include such things as small expendable engines, alternators, drones, missiles, remotely piloted vehicles etc. However, most of these applications involve high operating speeds and/or high temperature conditions. These represent severe conditions under which the bearings must perform, and are also conducive to excessive bearing heat generation during operation. It is to this problem that this investigation was directed.

The primary intent of this investigation was to determine if grooves in the bearing inner race would reduce bearing operating temperatures and heat generation by pumping relatively cool air into the bearing between the bearing retainer and inner race. A series of tests were conducted over a range of speed and load conditions to determine bearing stabilized operating temperatures. Bearing torque was monitored continuously. Other variables included in this study were bearing internal clearance, cage to land clearance, ball hole clearance, and groove depth. Bearing retainers made from silver-mercury-Teflon-molybdenum diselenide, and gallium-indium-tungsten diselenide composites were used to provide lubrication. Duration tests at a speed of

40,000 RPM were also attempted with grooved and ungrooved bearings. It was hoped at this speed that any beneficial effects of the grooves would be more apparent than previous data indicated. The duration test approach was taken since virtually no bearing performance information was available above 30,000 RPM.

DESCRIPTION OF TEST RIG

1. General

The basic test facility, which was designed and built by Southwest Research Inst. consisted of an air turbine to drive the test bearing, a bearing chamber, an oil system (which obviously was not required for the solid lube tests), bearing loading system, bearing heater (which also wasn't utilized for these tests), and the necessary instrumentation and controls. Photographs of the test facility are shown in Figures 1 and 2.

2. Basic Design

A detailed schematic of the rolling element bearing test rig is shown in Figure 3. The test bearing, A, is driven by the main shaft, B, which is powered by an air turbine, C. Air to the turbine is supplied by an auxiliary compressor via the nozzle ring, D. Externally-pressurized, orifice-compensated air bearings, having low friction characteristics at high speeds, are shown as E and F, and are employed to support the main shaft during operation. The outer race of the test bearing is supported in the test bearing holder, G, which is held in the test chamber, H. Thrust load is applied to the test bearing by the axial load piston, I, and radial load by the radial load pad, J. The test chamber is externally supported by two hydrostatic air bearings: the axial support pad, K, and the radial load pad, J, which serves a dual purpose in that it supports the test chamber in the radial direction on a hydrostatic air film and also applies a radial load through the air film to the test bearing. A shaft extension, L, extends through the test chamber lid and serves as the driver for the rotary transformer, M. The shaft extension, L, is hollow and provides a path for the electrical conductors from the inner race (test bearing) temperature transducer to the rotary transformer. A magnetic pickup, N, monitors the speed of the main shaft, B.



Figure 1. Solid Lube Bearing Test Facility Console

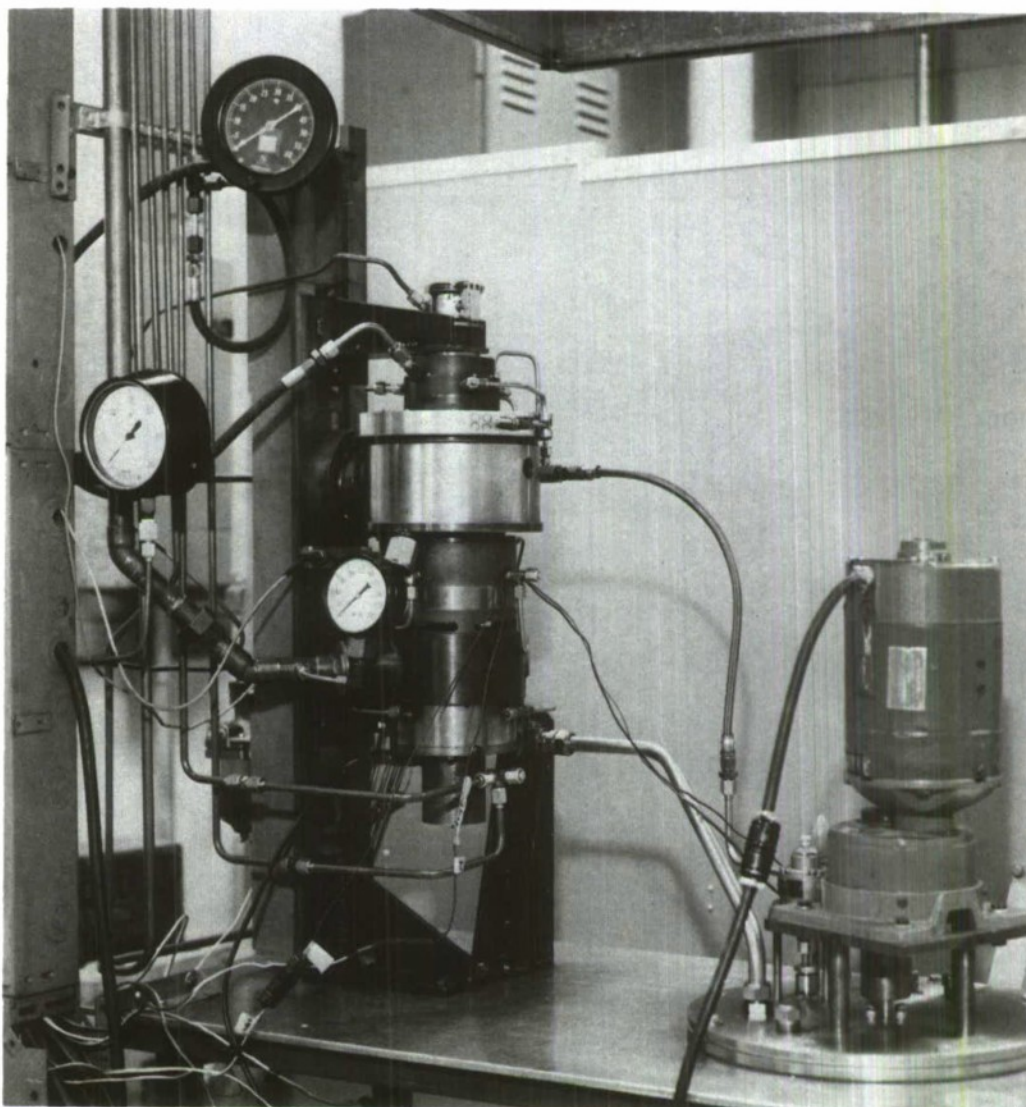


Figure 2. Solid Lube Bearing Test Facility Rig

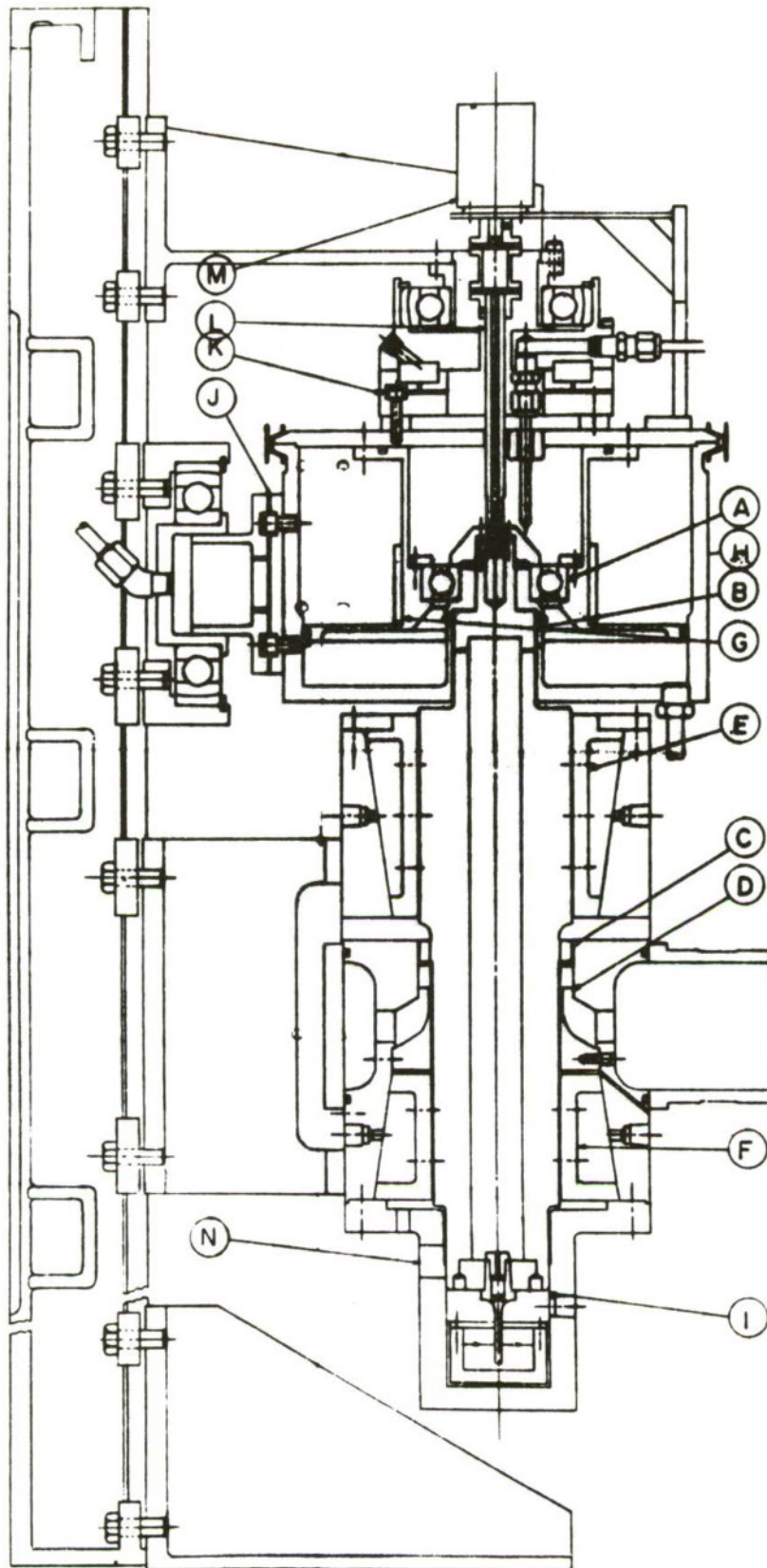


Figure 3. Schematic of Rolling Element Bearing Test Rig

3. Loading and Support System

The test rig was designed to allow the application of independently controlled thrust and radial loads on the test bearing. The thrust load, applied by means of the axial load piston, I, and the radial load applied by the radial load pad, J, are controlled with hand operated pressure regulators mounted in the instrument console. The amount of radial or thrust load is determined by the known piston size and the applied pressure which is indicated on the gauges in the instrument console.

Filtered air is supplied to the two support air bearings, E and F, through an air manifold. These bearings are orifice compensated and were designed to operate at 200 to 250 psig on clean dry air. Practical operating experience has shown that if the supply air is contaminated with either water or oil the high speed capability of the rig is severely reduced due to the deleterious effects of these contaminants on the solid lubricant coating which is applied to the journal surfaces of the air bearings.

4. Bearing Torque Measurement

Torque due to test bearing friction, which tends to rotate the test chamber, H, is measured with strain gages which are attached to a metal leaf spring. The leaf spring deflects when torsional load is applied and produces a resistance change in the strain gage bridge, which in turn gives an electrical output that is calibrated and employed as a measure of bearing torque. Since the radial and axial hydrostatic air pads offer negligible torsional resistance, the indicated torque is an accurate measure of test bearing torque. The torque is indicated directly on a Sanborn Model 311A transducer amplifier, and recorded simultaneously on a Honeywell recorder.

5. Inner Race Temperature Measurement

Test bearing inner race temperature is measured with a sub miniature size surface type temperature transducer which is 0.25 in. x 0.20 in. x 0.04 in. thick. It is a low mass, platinum sensor with 100 ohms resistance at the ice point. The sensor is located in a machined cavity directly beneath the test bearing inner race. Centrifugal forces due to rotation of the main shaft force the sensor against the bore of the inner race and provide an inner race temperature measurement. Output from the transducer is coupled from the rotating shaft to a stationary location by employing a rotary transformer. From the transformer the temperature is indicated directly on a Himmelstein meter located in the instrument console.

6. Drive System

The drive system consists of an air driven turbine, C, located approximately at the mid length of the main shaft, B. Air is supplied to the turbine by an auxiliary compressor via a nozzle ring, D. To obtain maximum speed, which is approximately 60,000 rpm, approximately 125 scfm of air at 100 psig is needed. Main shaft speed is monitored with an electronic tachometer mounted in the instrument console. Input to the tachometer is from a magnetic pickup whose interrupted signal is provided by 6 recesses located at the bottom most section of the main shaft.

7. Test Bearings and Retainers

The basic ball bearing geometry, a 204 size bearing with a 20 mm bore, used to conduct the solid lubricated bearing tests is shown in Figure 4. This geometry does not contain bearing internal clearance information since this parameter was varied from test to test. All of the test



Some of the bearings utilized in these tests had inner races with machined grooves located around the circumference on the lands at either side of the ball groove. Figure 5 shows a detailed drawing of the grooves. Two different groove depths, 1 and 3 mils, were utilized. The intent of the grooves was to pump cooling air into the bearing by virtue of self-rotation of the inner race during operation.



The cages used with the above described bearings were developed by Westinghouse Research Laboratories (Ref 1 & 2). They were comprised of a self-lubricating composite contained within a 303 stainless steel, reinforcing shroud assembly. Two different self-lubricating composite materials were utilized. One was a silver amalgam matrix in which was distributed a mixture of MoSe_2 and PTFE (Teflon) particles. Its theoretical volume-percent composition is: 70 AgHg-20 WTFE-10 MoSe_2 . The Teflon component of this composite material is designated WTFE (waxy Teflon) because it has been chemically modified to exhibit a sharp melting point at approximately 590°F and, upon resolidification, has a waxy appearance. The second composite material was also an amalgam with the following theoretical weight-percent composition: 80WSe₂ - 20 GaIn. Further details on these materials, which in later sections will be referred to as AgHg and WGI, can be found in Ref 1. The basic geometry of the solid lubricant composite plus metal shroud (retainer) is shown in Figure 6.

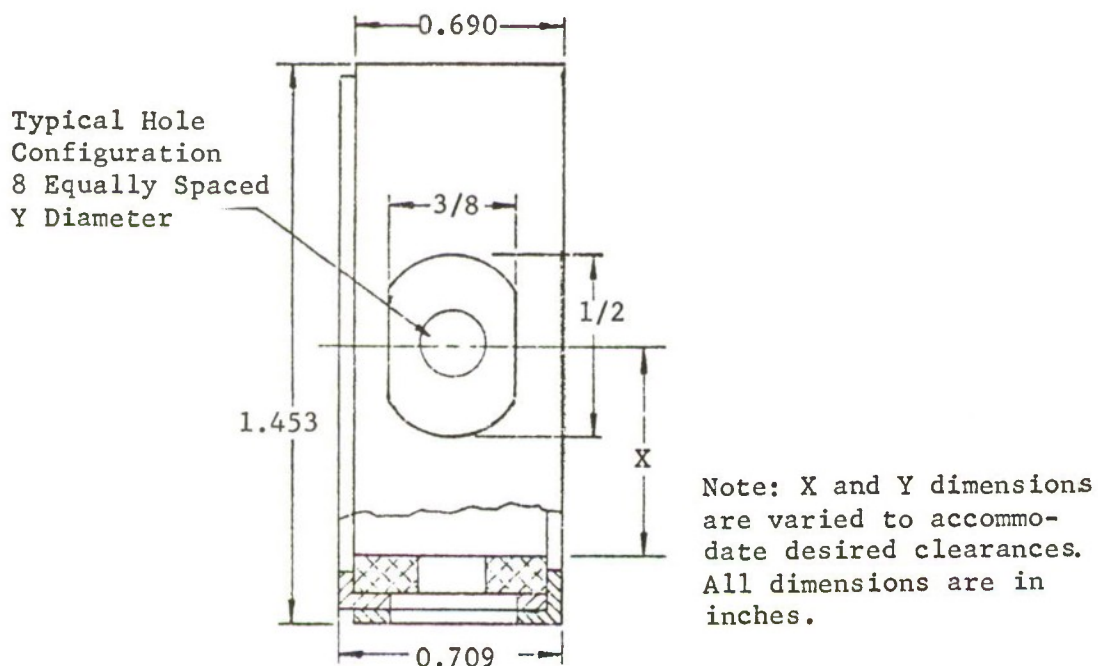


Figure 6. Solid Lubricant Retainer Geometry



Figure 7. Photograph of Grooved Bearing

The retainer inside diameter and ball hole diameters are not indicated on this drawing because they were varied from test to test in order to get the desired retainer-bearing inner race and ball hole clearances. A photograph of a new, unused bearing (with grooves) and retainer is presented in Figure 7.

TEST PROCEDURE

The test procedure used to conduct the solid lubricated bearing tests is described below.

1. Test Bearing Preparation

The test bearings were prepared in the following manner prior to installation in the test rig:

- a. Initial degreasing in Stoddard solvent.
- b. Rinse in fresh methylene chloride.
- c. Final wash in ethyl alcohol.
- d. Composite cage installation and storage in dessicator until ready for test.

2. Test Start-up and Running Sequence

- a. After the bearing is assembled in the test rig, rotation is initiated with full axial load and zero radial load.
- b. Bearing speed is then increased to the desired value and the radial load, if any, is applied.
- c. The bearing is then allowed to operate at a given speed and load condition until a stabilized bearing temperature is obtained. While waiting for the temperature to stabilize, intermediate values of torque and temperature were recorded every 15 minutes. Stabilized temperature operation was considered to have been reached when any two successive recordings of torque and temperature were identical. In general, stabilized temperatures were usually reached within 30 minutes after application of a new load or speed condition.

For the first several tests both inner and outer race temperatures were measured. However, it was found that oil used to cool and lubricate the rotary transformer (which is used in conjunction with the inner race temperature sensor) was leaking into the test chamber and contaminating the test bearing. Attempts were made to correct the problem but none of them were entirely satisfactory. As a result, it was decided to eliminate the transformer and discontinue the inner race temperature measurement.

d. The sequence of running each test was to cover the entire speed range at each level of thrust load to be investigated. No radial load was applied for these tests. Once the range of thrust loads was covered, radial load was applied at a given level of thrust load and then successively increased until the entire range of radial load was covered.

DISCUSSION OF RESULTS

1. General Comments

An overall summary of the test series conducted is presented in Table I. Series 20 through 24 are not included as they were conducted in a different manner. Several facts are readily apparent. Of the 19 test series conducted only 4 were not stopped prematurely for one reason or another. All of these had bearings with silver-mercury-molybdenum diselenide retainers. It should be noted that bearing cage unbalance problems played a predominant role in contributing to curtailed test series runs. Figures 8 and 9 show the effect of the unbalance on bearing operation. As can be seen, rub on both the retainer I.D. and O.D. resulted. This unbalance prevented the acquisition of sufficient data on both grooved and ungrooved bearings to make a valid assessment of their effectiveness. The effects of such variables as speed, radial load and axial load upon bearing heat generation and operating temperature were consistent, however, and similar to those observed by other investigators (see Refs. 1-6).

2. Bearing Retainer Material Effects

Figures 10 through 14 present the test data by series test number. These included measured bearing outer and inner race temperature data and bearing torque. The average data values for each test series are shown as well as the average value for all test series. In general, both inner and outer race temperatures were lower for bearings with AgHg cages than those with WGI retainers. A similar trend for bearing torque values is not nearly as evident from figure 14.

TABLE I
TEST SERIES SUMMARY

TEST SERIES NO.	RETAINER MATERIAL	BEARING INTERNAL CLEARANCE INCHES	BALL HOLE CLEARANCE INCHES	CAGE LAND CLEARANCE INCHES	BEARING GROOVE DEPTH INCHES	TOTAL OPERATING TIME HOURS	REMARKS
1	AgHg	0.005	0.010	0.015	0.003	7.1	ball-shroud contact, unbalance, oil
2	WGI	0.005	0.010	0.015	NONE	20.5	ball shroud contact,oil
3	AgHg	0.005	0.010	0.015	NONE	37.8	test series completed w/o problems
4	AgHg	0.005	0.010	0.015	NONE	20.7	to check O.R. temp, torque w/o IR sensor
5	AgHg	0.005	0.010	0.015	0.003	34.2	test series completed, oil
6	WGI	0.010	0.017	0.022	NONE	7.0	unbalance
7	WGI	0.010	0.017	0.022	NONE	2.5	unbalance
8	WGI	0.010	0.017	0.022	NONE	1.8	unbalance
9	WGI	0.010	0.017	0.022	NONE	2.3	ball shroud contact
10	WGI	0.010	0.017	0.022	NONE	2.5	unbalance
11	AgHg	0.010	0.017	0.022	NONE	34.4	Test series completed w/o problems
12	AgHg	0.010	0.017	0.022	0.001	2.0	unbalance
13	AgHg	0.010	0.017	0.022	0.001	1.5	unbalance
14	AgHg	0.010	0.017	0.036	0.001	19.0	
15	WGI	0.005	0.017	0.022	0.003	6.9	unbalance
16	WGI	0.005	0.017	0.022	0.003	0.0	defective bearing
17	AgHg	0.010	0.010	0.015	0.001	3.7	unbalance
18	WGI	0.005	0.010	0.015	NONE	9.2	unbalance
19	WGI	0.005	0.010	0.015	NONE	2.9	unbalance

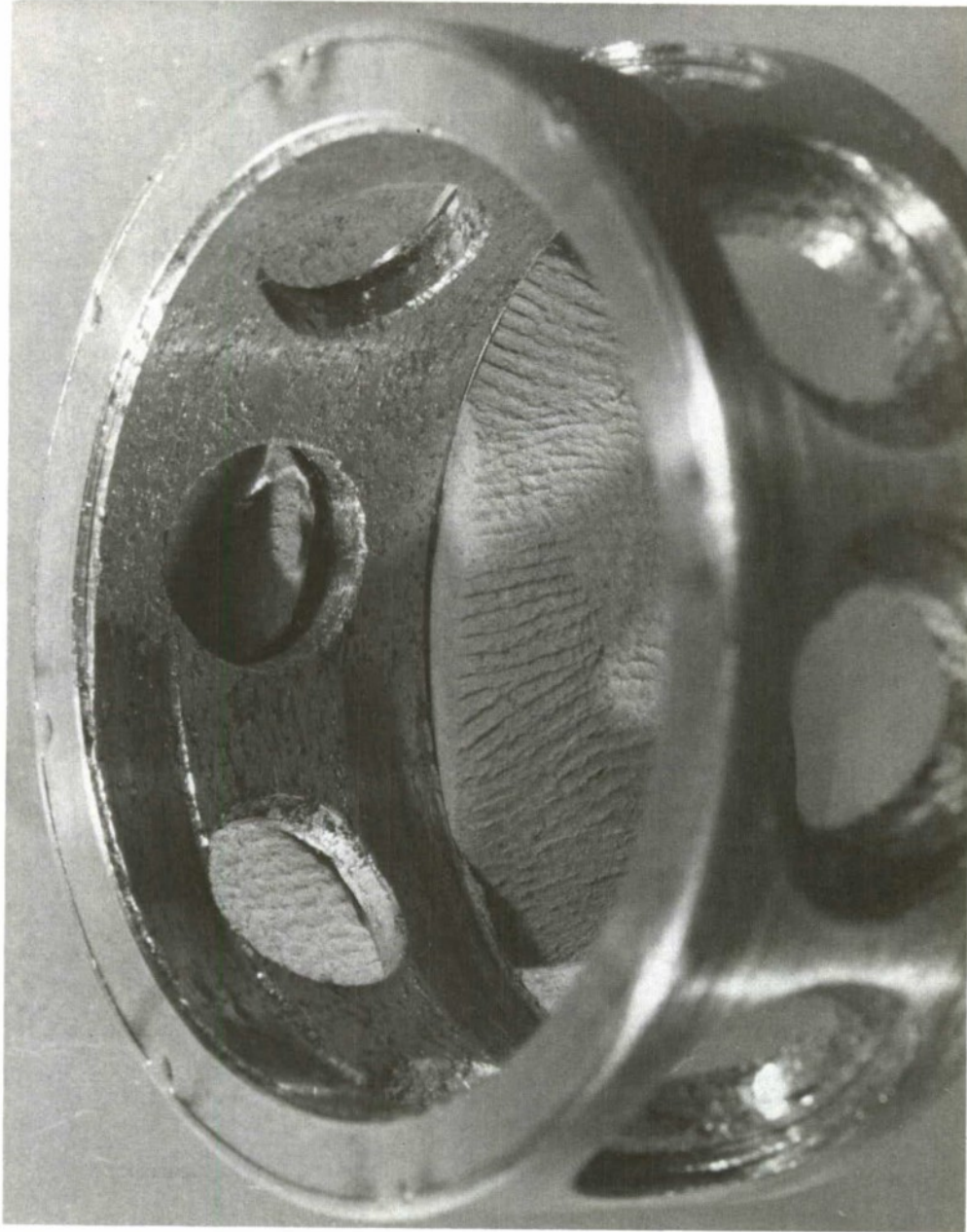


Figure 8. Effects of Cage Imbalance on Retainer Wear - Cage I.D.

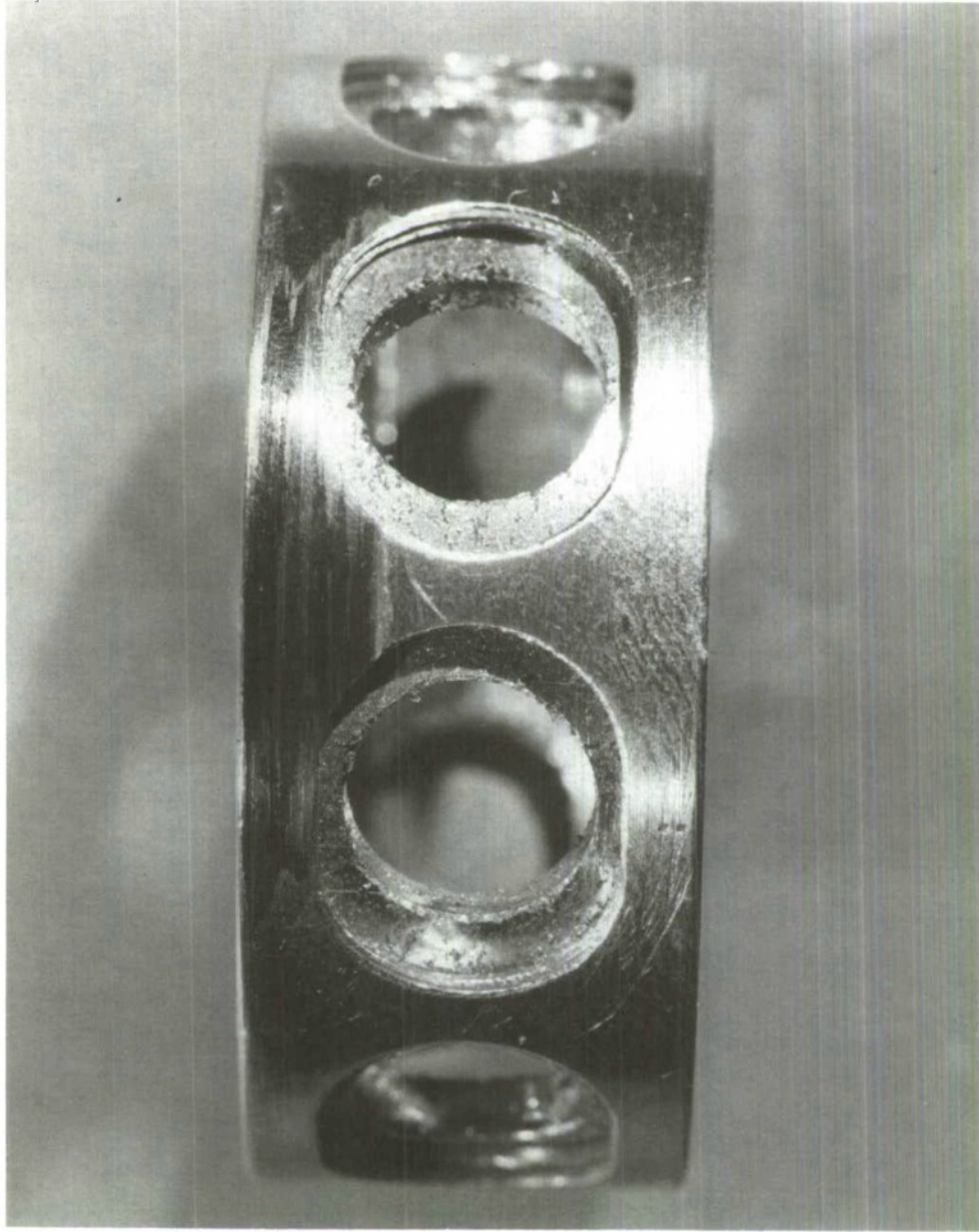


Figure 9. Effects of Cage Imbalance on Retainer Wear - Cage O.D.

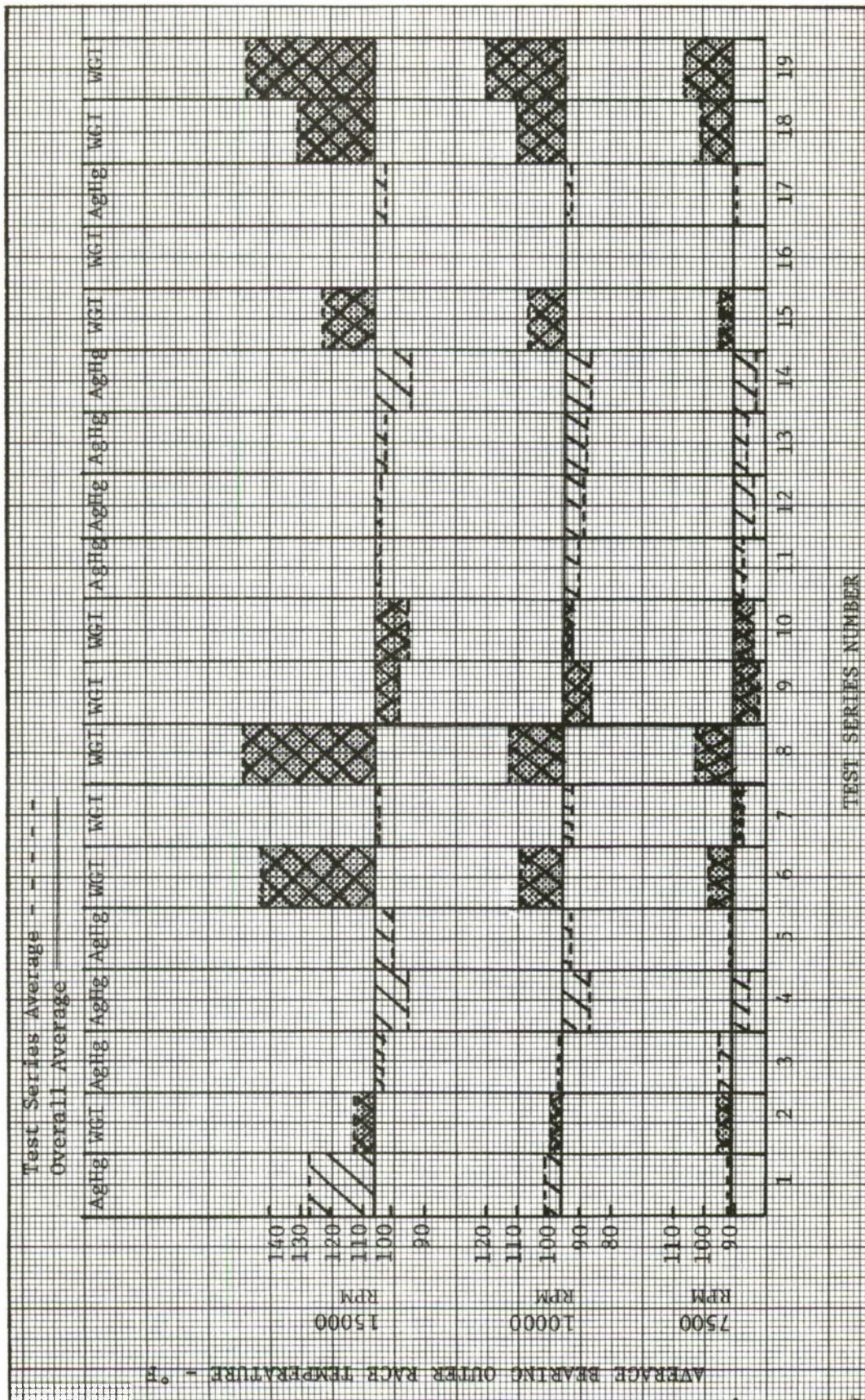


Figure 10. Avg. Bearing Outer Race Temperature at Constant Speed by Test Series Number - 7500, 10,000, and 15,000 RPM

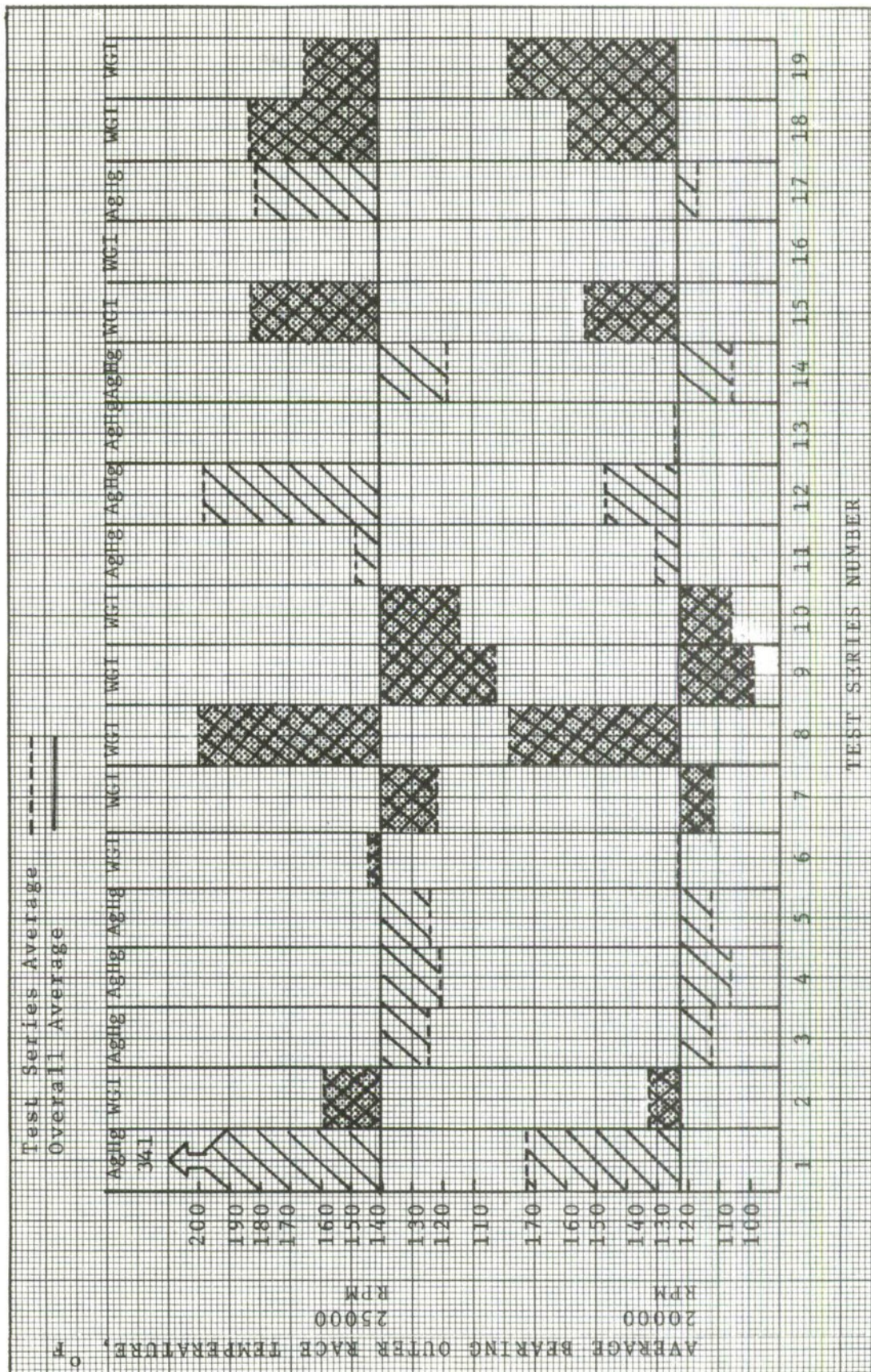


Figure 11. Avg. Bearing Outer Race Temperature at Constant Speed
 by Test Series Number - 20,000 and 25,000 RPM

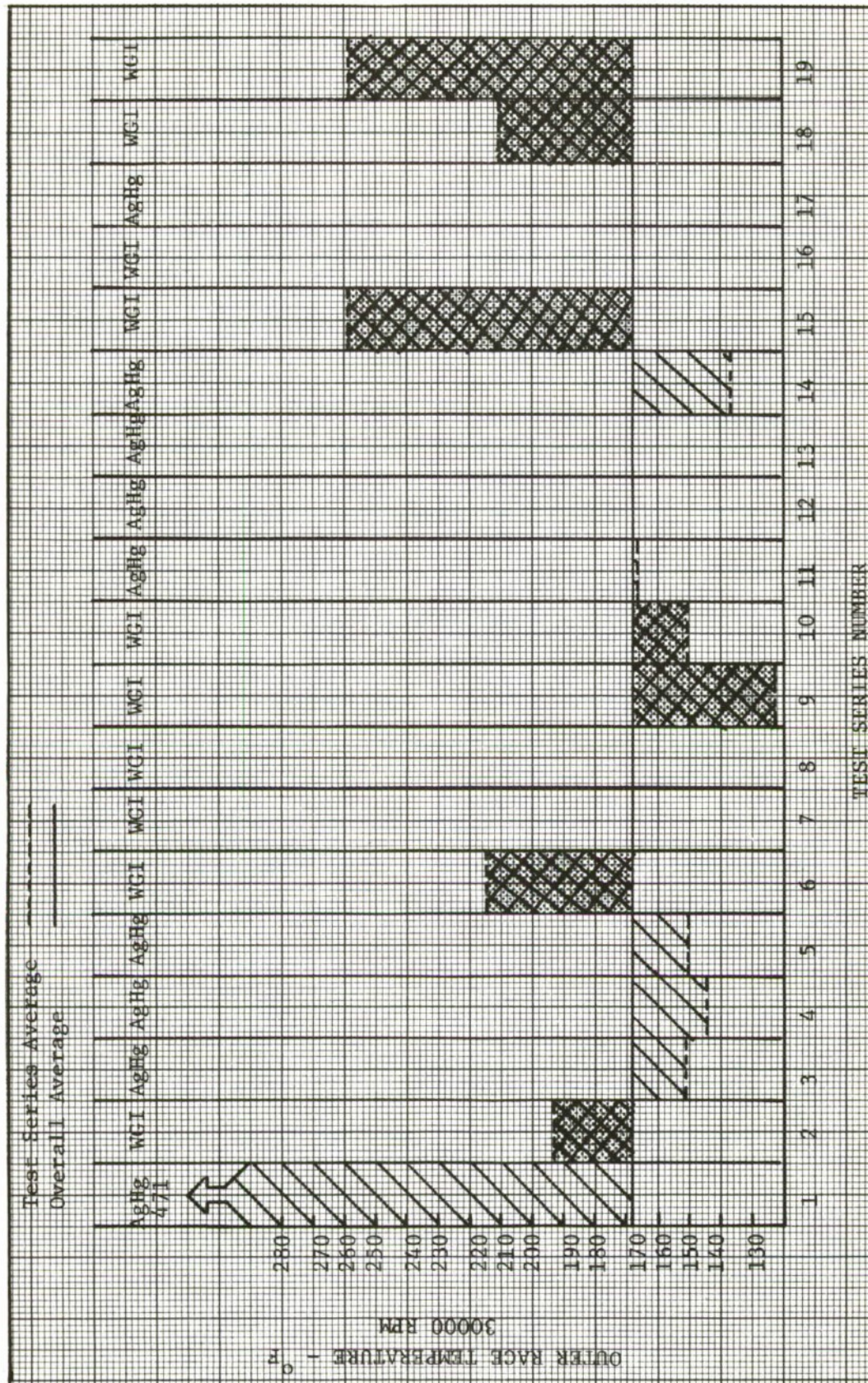


Figure 12. Avg. Bearing Outer Race Temperature at Constant Speed
by Test Series Number - 30,000 RPM

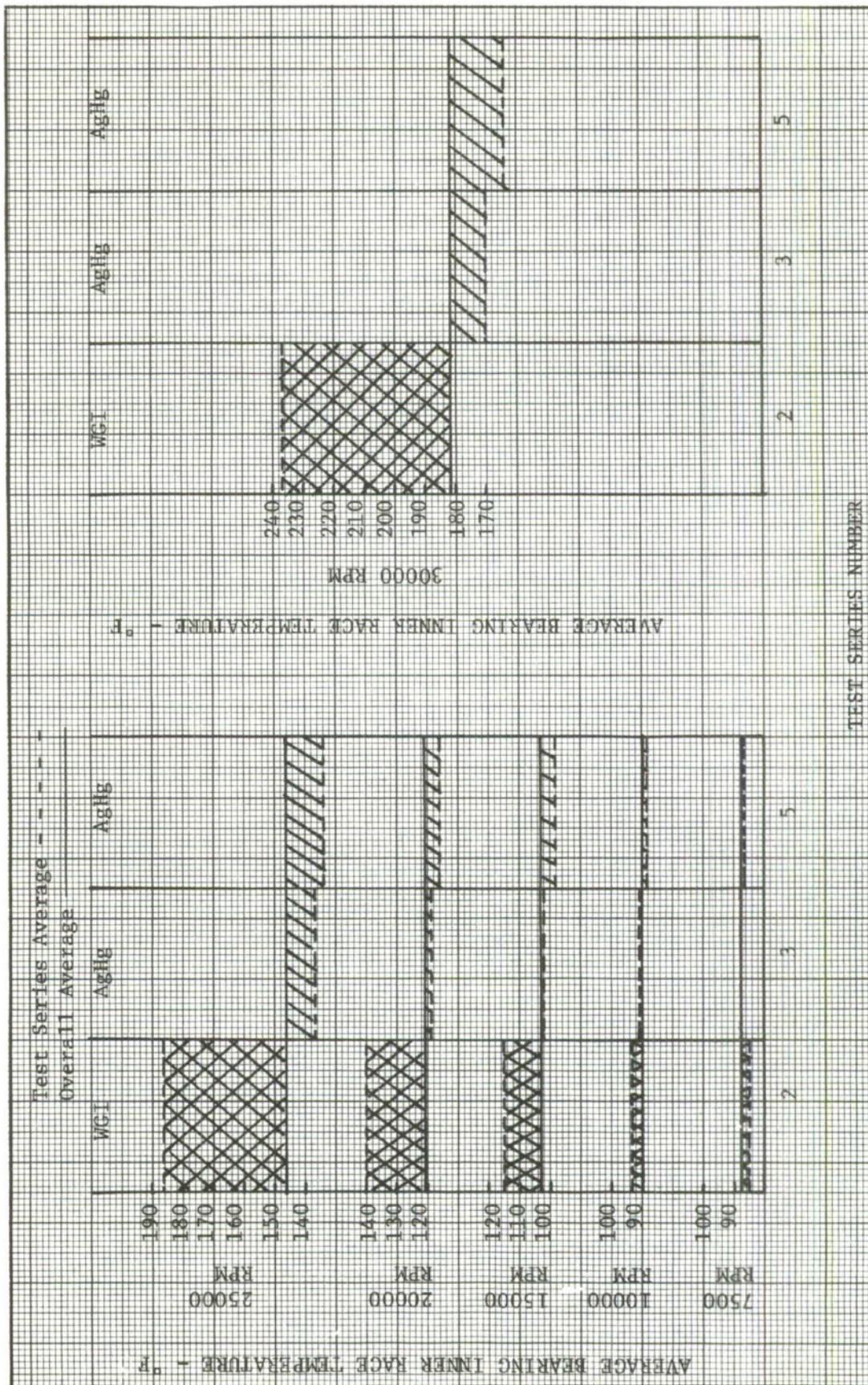


Figure 13. Avg. Bearing Inner Race Temperature at Constant Speed
by Test Series Number - 7500, 10,000, 15,000, 20,000, and 25,000 RPM

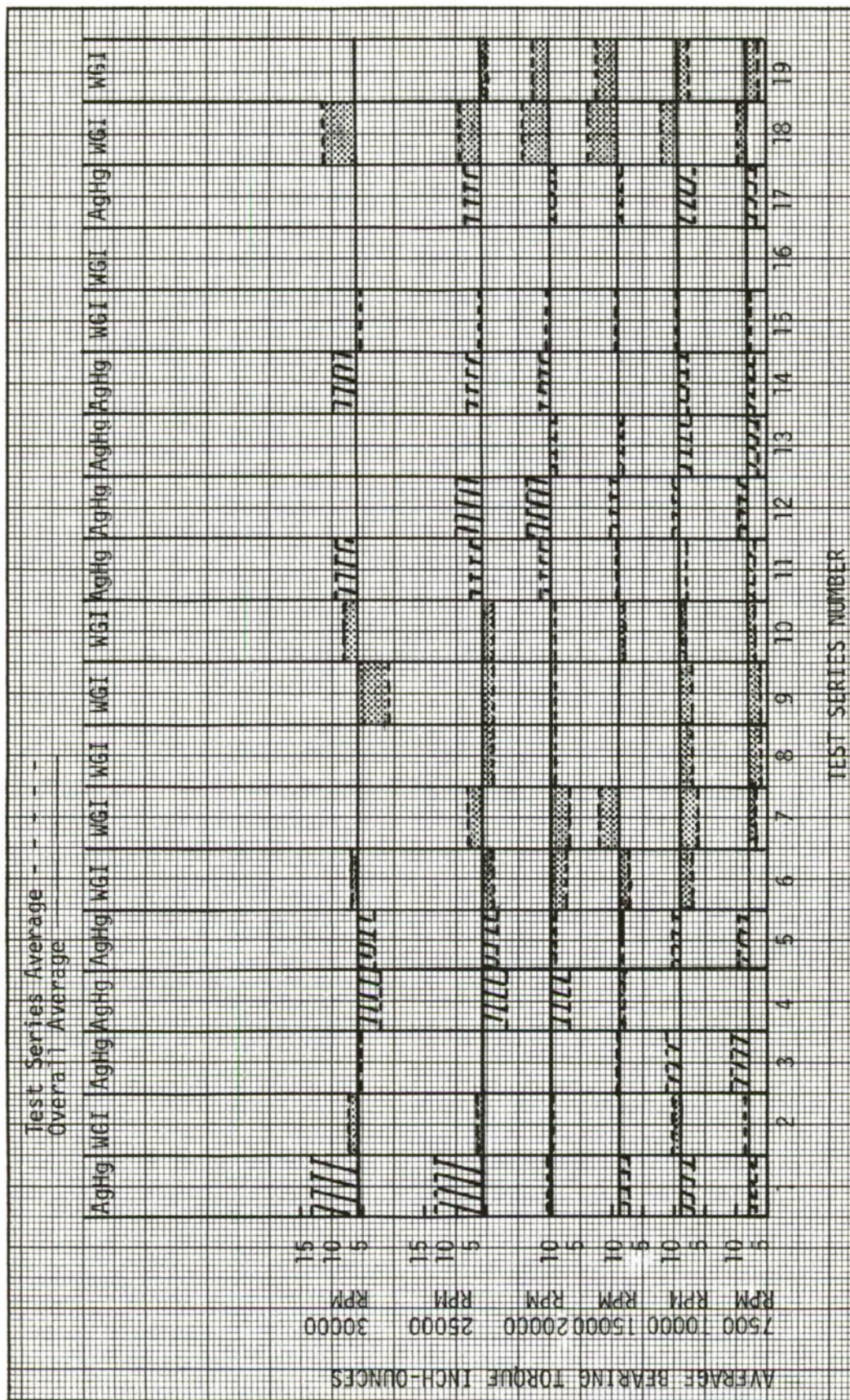


Figure 14. Avg. Bearing Torque at Constant Speed by Test Series
 Number - 7500, 10,000, 15,000, 20,000, 25,000, and 30,000 RPM

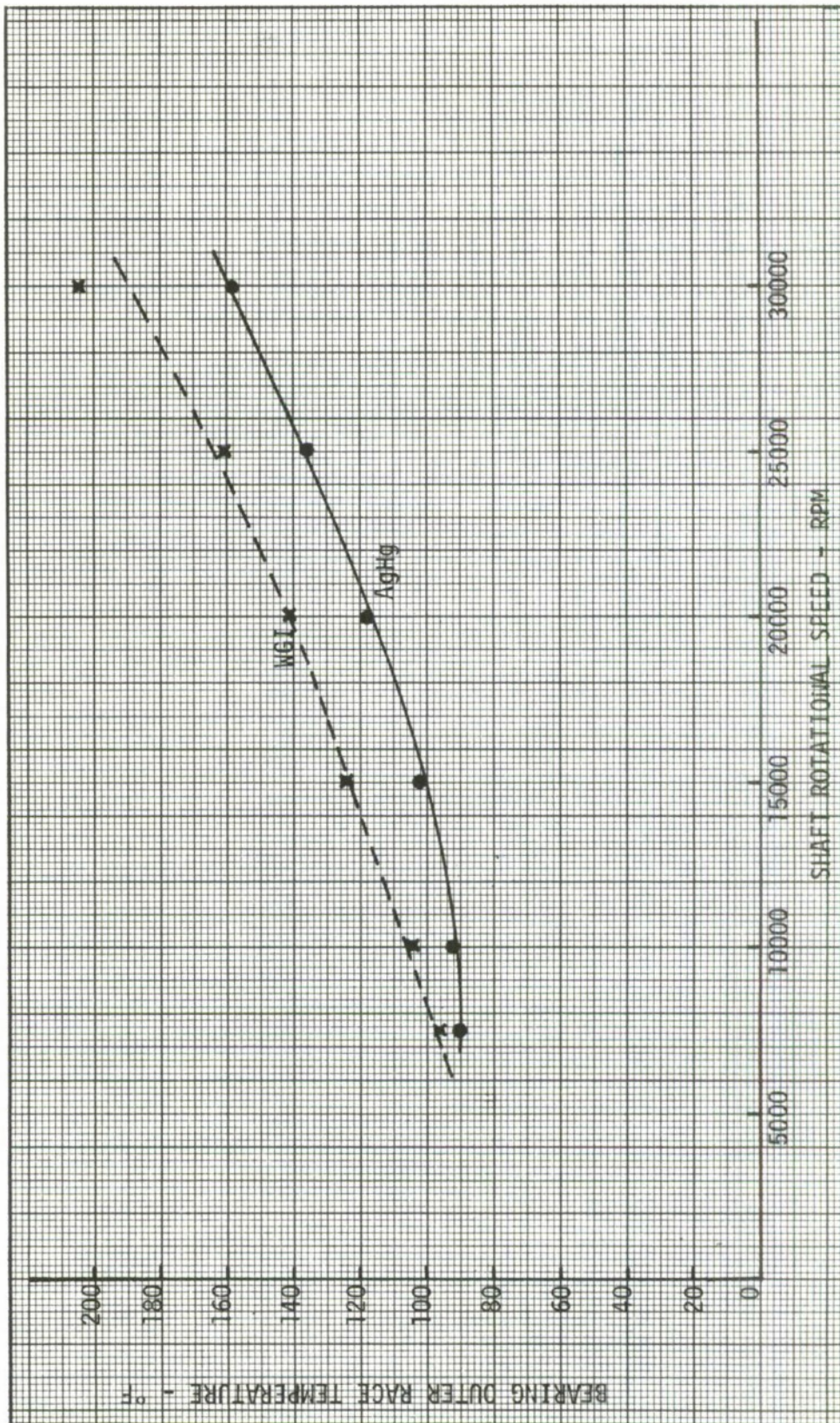


Figure 15. Variation of Avg. Bearing Outer Race Temperature with Shaft Rotational Speed for Bearings with WGI and AgHg Retainers

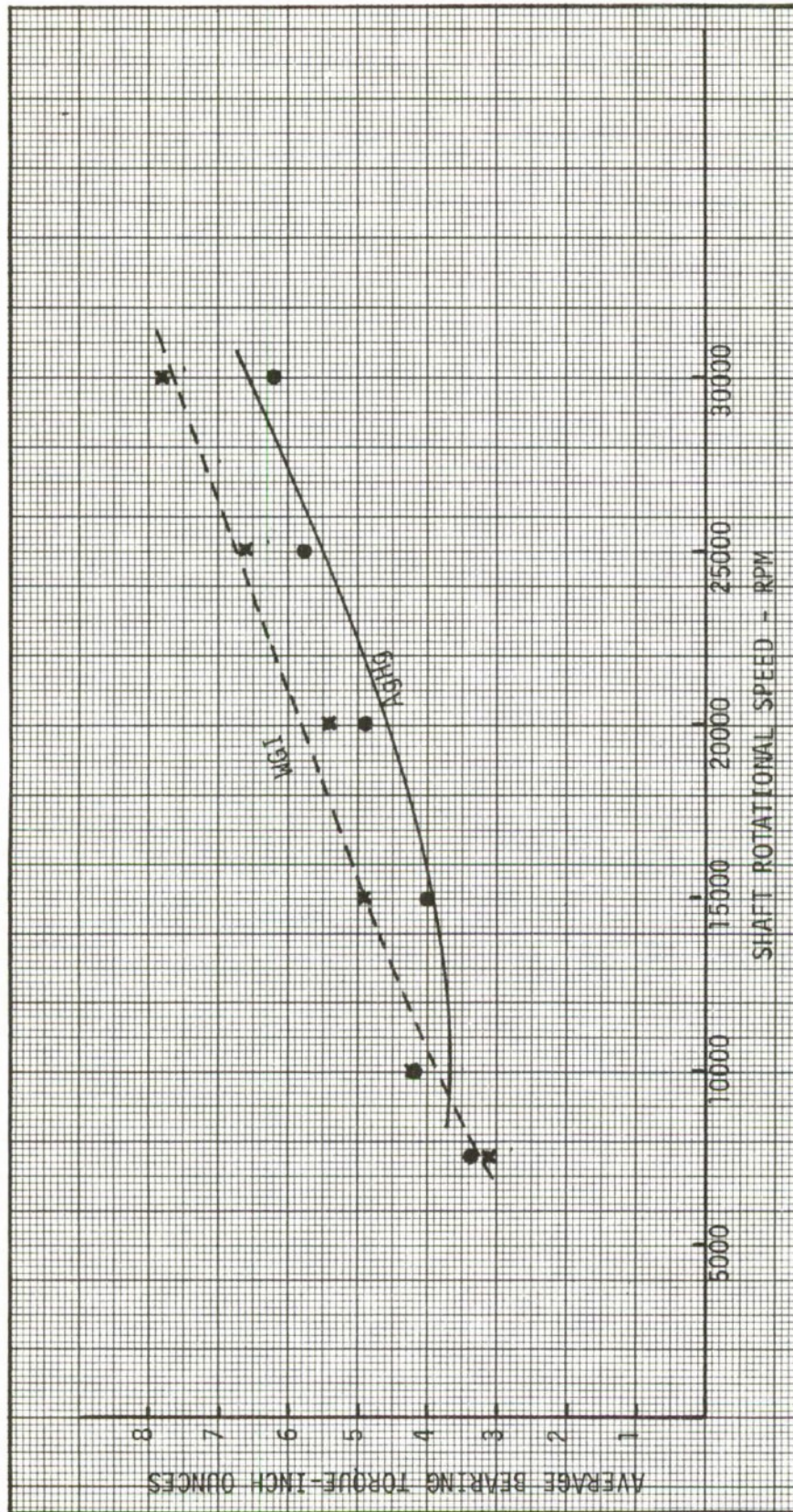


Figure 16. Variation of Avg. Bearing Torque with Shaft Rotational Speed for Bearings with WGI and AgHg Retainers

However, when average bearing outer race temperatures and torque values are related as a function of shaft rotational speed and bearing retainer cage material, a distinct difference is apparent. These relationships are shown in Figures 15 and 16. In both cases the AgHg composites cages operated cooler and with less torque at any given speed. The differences below 10,000 RPM are probably indistinguishable and may be considered the same for both materials.

3. Bearing Load Effects

It was not anticipated that bearing loads would have an overriding effect on temperature levels or torque values. This was verified as shown in Figures 17 through 20. Here the effects of both radial and axial loads upon average bearing outer race temperature and torque for both materials are presented. Both materials are included since the same results were seen for both materials. In the radial load range of 0-75 pounds and the axial load range of 50 to 150 pounds the load effects were minimal.

4. Speed Effects

The overriding parameter affecting bearing operating temperature and torque was shaft rotational speed. For this reason it was necessary to include speed as a separate variable for all of the relationships shown. This is directly translatable into an effect on bearing heat generation rate as well, since, that too, is a function of speed and torque. The effect of speed on bearing outer race temperature and torque is shown in figure 21 and 22. These parameters increase significantly with increasing shaft rotational speed.

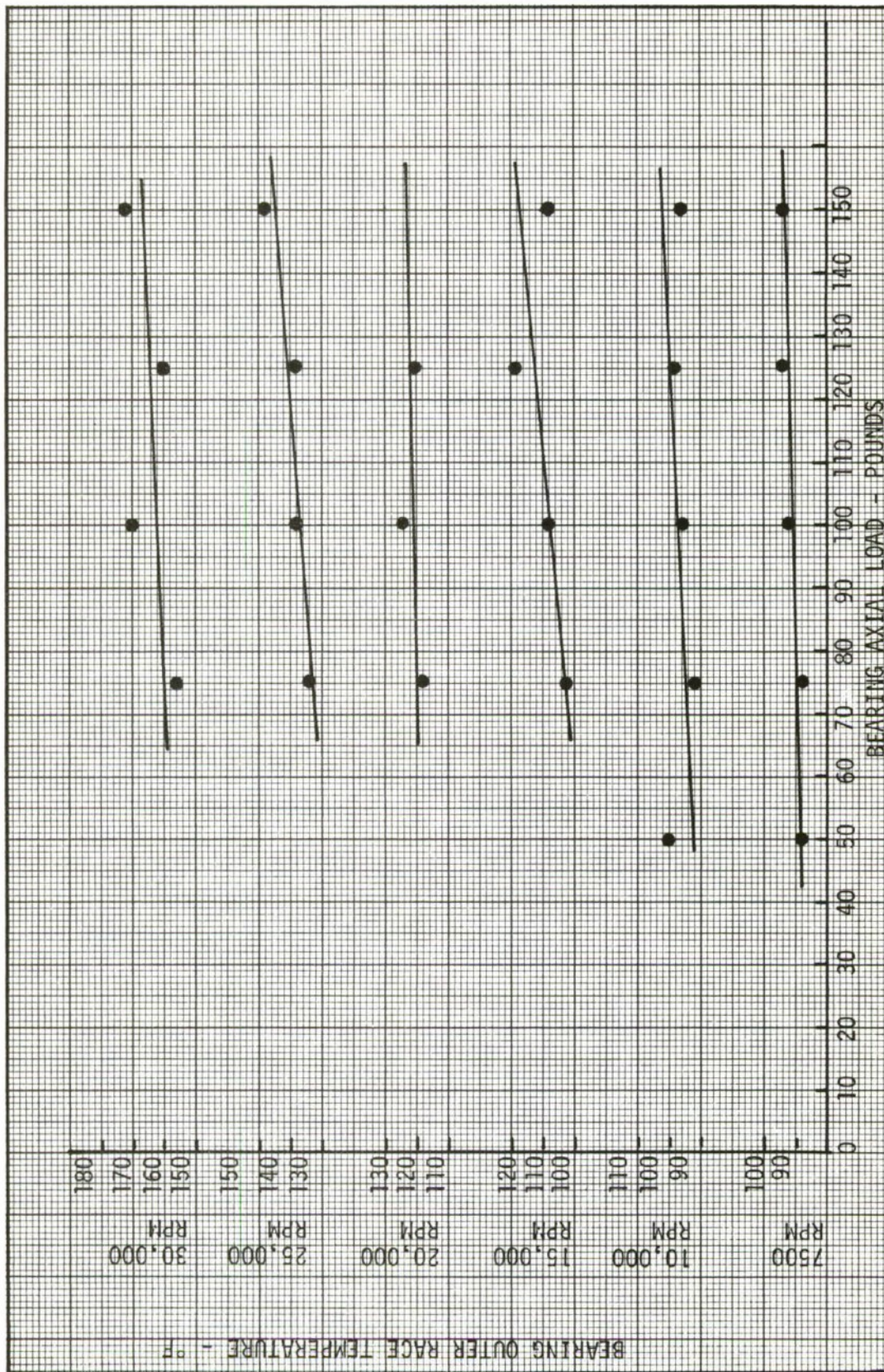


Figure 17. Variation of Avg. Bearing Outer Race Temperature with Bearing Axial Load at Constant Speed

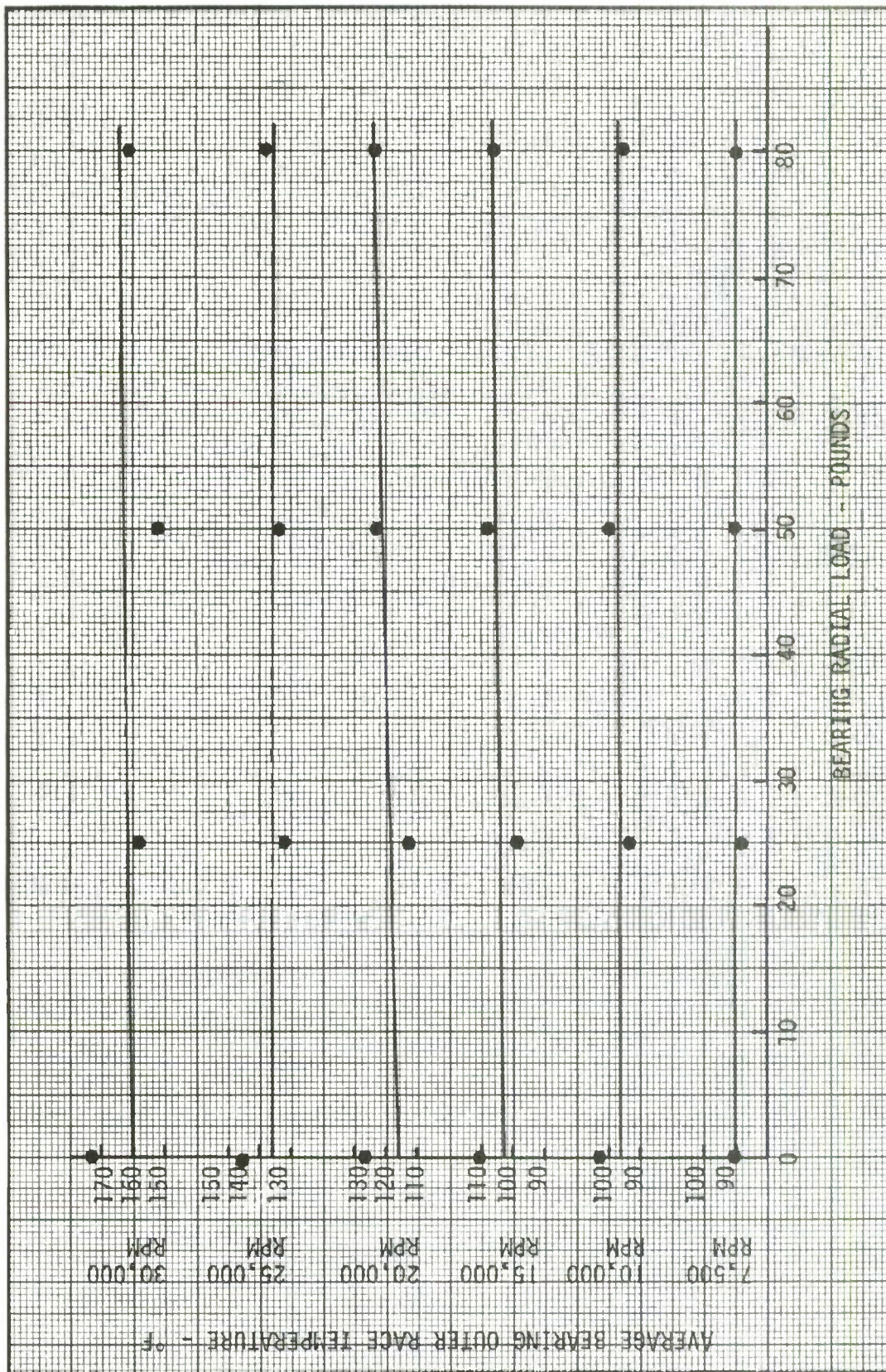


Figure 18. Variation of Avg. Bearing Outer Race Temperature with Bearing Radial Load at Constant Speed

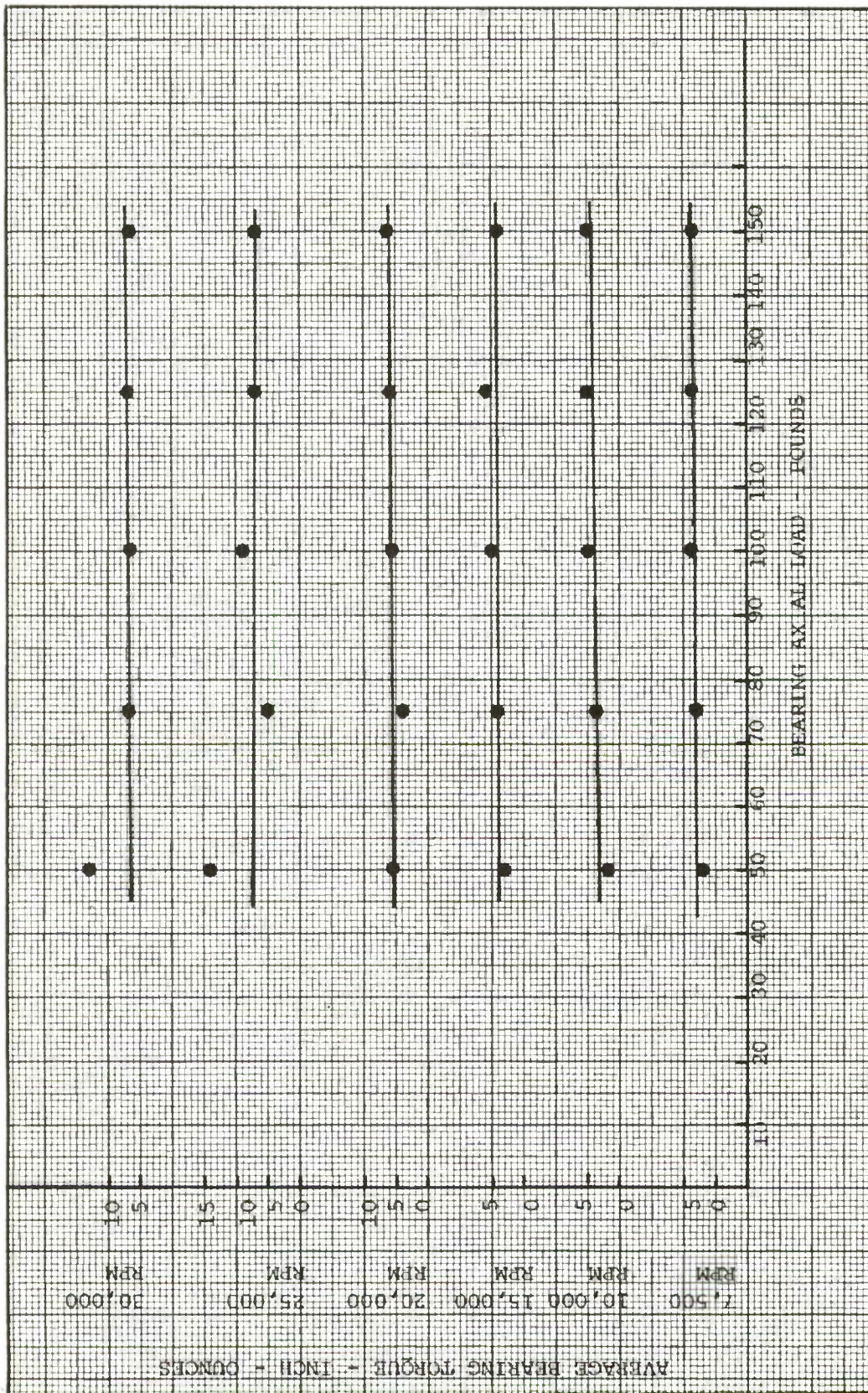


Figure 19. Variation of Avg. Bearing Torque with Bearing Axial Load at Constant Speed

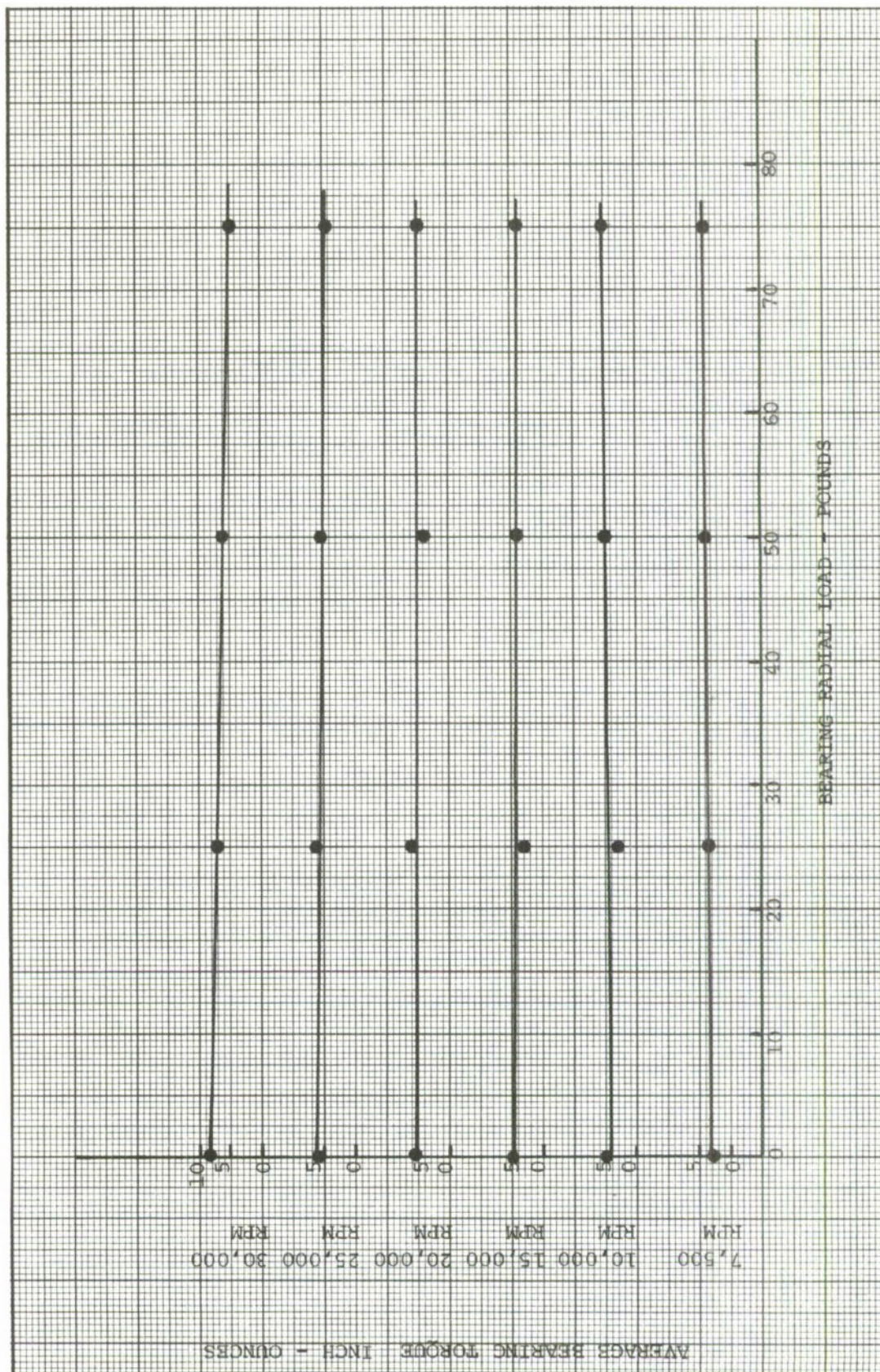


Figure 20. Variation of Average Bearing Torque with Bearing Radial Load at Constant Speed

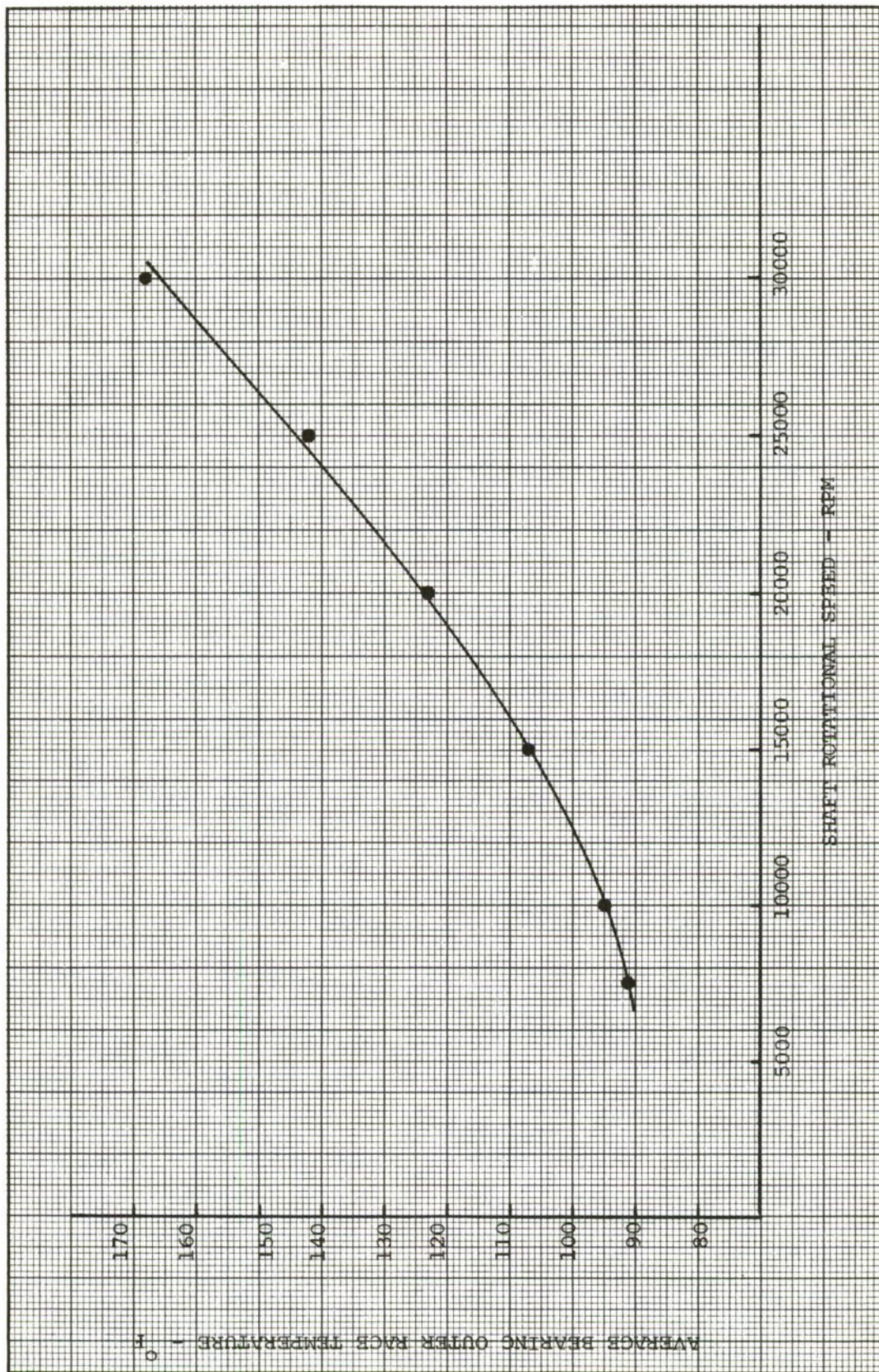


Figure 21. Variation of Average Bearing Outer Race Temperature with Speed

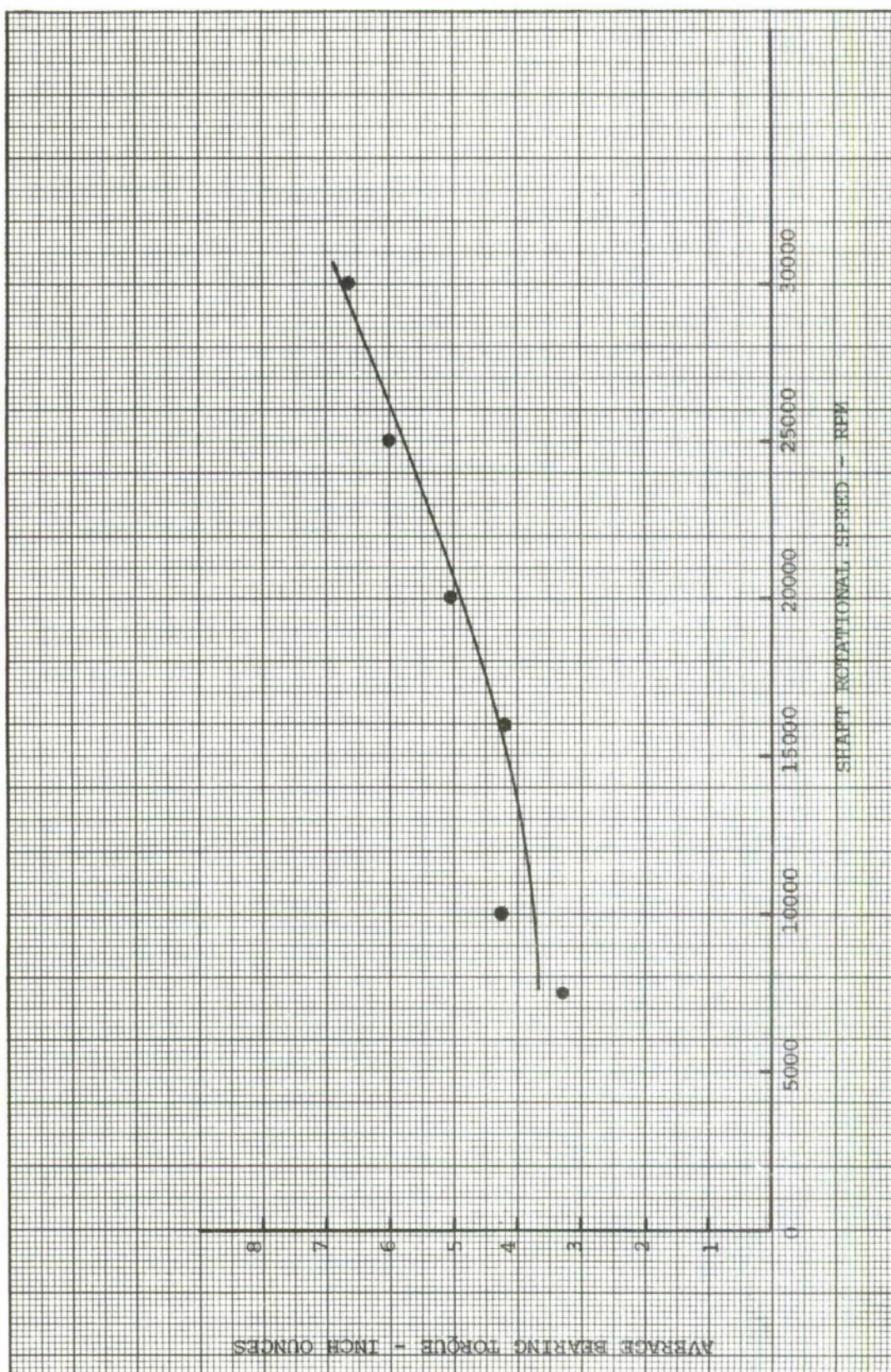


Figure 22. Variation of Average Bearing Torque with Speed

5. Bearing Heat Generation

Translation of the data into bearing heat generation information is based on the equation relating heat generation as a function of speed and torque (Ref 4). Calculated results are shown in Table II. Heat generation as a function of speed is shown in Figures 23 through 26 for each of the 19 series of tests. An attempt was made to include bearing geometry and bearing cage material as variables. All figures show the average heat generation value for the 19 test series, as well. This was used as a reference to make comparisons of the data easier.

Since no grooved bearing data for the WGI retainers is available, no comparisons were made. From the data accumulated, it appears however, that the larger clearance bearings, in general, ran cooler than the smaller clearance ones when equipped with WGI cages.

The data on bearings using AgHg retainers was somewhat the opposite. In general, small clearance bearings ran cooler than the larger clearance ones. There was no consistency with respect to the presence of grooves or groove depth. Some performed better and some performed worse than ungrooved bearings. This was true for both groove depths of 0.001 and 0.003 inches. For this reason it is not possible to determine if grooving the bearings was beneficial, detrimental or had any effect at all on bearing heat generation or operating temperature.

6. 40,000 RPM tests

It was hoped from this test series that at a high operating speed the effects of bearing grooves would be more apparent. Since operating experience at this speed was almost non-existent, it was decided to eliminate varying axial and radial load conditions and to monitor bearing performance in a duration type test. It was intended to run comparable tests on bearings

with both retainer types with grooved and ungrooved bearings. Due to bearing cage unbalance problems, however, the only successful runs were made with ungrooved bearings with AgHg retainers. Tests 21, 22 and 23 were all curtailed after about 15 minutes operation due to severe cage unbalance situations.

Figures 27 through 29 show the variation of bearing outer race temperature, torque and heat generation with time for test no. 20. Bearing temperature although fluctuating showed a gradual increase with time. The fourteen and a half hour run is the longest time a solid lubricated bearing has operated at 40,000 RPM. The torque and heat generation curves have the same shape since one is calculated as a direct function of the other. After a fluctuating start both remained steady for a number of hours and then increased steadily until the end of the test.

Figure 30 shows similar data for test number 24. The bearing outer race temperature rose sharply at the start, fell somewhat, then increased gradually with time until the test was ended. Sharply rising temperatures at the end along with a very high torque reading indicated a bearing problem. Bearing torque and heat generation rose slightly to a constant level and remained there for a few hours. They then dropped steadily and somewhat sharply with time until the sudden increase occurred. Torque levels ran throughout the test at a level significantly higher than those in test 20. The only difference between tests number 20 and 24 is that bearing and cage clearances were small in test 20 and larger in 24. Why torque increased in one case and decreased in the other is not known nor can it be conclusively stated that the torque level variation was attributed to the variations in bearing geometry since unbalance problems were encountered.

TABLE II
BEARING HEAT GENERATION CALCULATIONS

The basic heat generation equation used was $Q = 0.0404 \tau \times N$ (Ref 4) where Q is the heat generation rate in BTU/hr, τ is bearing torque in inch pounds and N is speed in RPM. Using average torque values for each speed condition heat generation rates were calculated for the different test series.

Test Series	Avg τ N	in-Oz 7500 =18.9375 τ	in-Oz 10000 =25.25 τ	in-Oz 15000 =37.875 τ	in-Oz 20000 =50.50 τ	in-Oz 25000 =63.125 τ	in-Oz 30000 =75.75 τ	Mat'l	Clearances Mils	Grooves Mils	Remarks
No.											
1	37.875	50.500	94.688	284.315	852.188	1022.625	AgHg	5-10-15	3		
2	70.258	137.865	151.500	239.875	428.619	584.033	WGI	5-10-15	NONE		
3	104.156	154.278	175.740	246.945	371.806	421.928	AgHg	5-10-15	NONE		
4	55.676	104.283	109.080	107.565	126.250	199.223	AgHg	5-10-15	NONE		
5	80.484	132.058	126.881	203.010	239.244	267.398	AgHg	5-10-15	3		
6	56.813	54.793	88.249	126.250	284.063	530.250	WGI	10-17-22	NONE		
7	37.875	25.250	265.125	101.000	536.563	-	WGI	10-17-22	NONE		
8	18.938	50.500	151.500	202.000	252.500	-	WGI	10-17-22	NONE		
9	18.938	50.500	151.500	202.000	252.500	75.750	WGI	10-17-22	NONE		
10	37.875	75.750	113.625	202.000	252.500	643.875	WGI	10-17-22	NONE		
11	37.118	71.963	174.983	316.635	463.969	703.718	AgHg	10-17-22	NONE		
12	75.750	126.250	189.375	429.250	631.250	-	AgHg	10-17-22	1		
13	18.938	50.500	113.625	202.000	-	-	AgHg	10-17-22	1		
14	35.603	69.438	160.969	315.625	493.006	752.198	AgHg	10-17-36	1		
15	50.563	109.333	176.876	269.165	389.481	416.625	WGI	5-17-22	3		
16	-	-	-	-	-	-	WGI	5-17-22	3		
17	28.406	37.875	113.625	202.000	552.344	-	AgHg	10-10-15	1		
18	75.750	167.408	317.393	467.125	599.688	862.035	WGI	5-10-15	NONE		
19	18.938	50.500	265.125	378.750	315.625	-	WGI	5-10-15	NONE		
Sm. C1. AgHg	69.548	110.280	126.597	210.459	397.372	477.794	Avg AgHg	5-10-15			
L9. C1. AgHg	41.852	79.538	159.738	315.878	529.408	727.958	Avg AgHg	10-17-22, 36			
	28.406	37.875	113.625	202.000	55.344		AgHg	10-10-15			
TOTAL AgHg	52.667	88.572	139.885	256.372	466.257	561.182	Avg All AgHg				
Sm C1 WGI	54.982	118.591	244.673	361.917	447.977	723.034	Avg WGI	5-10-15			
L9 C1 WGI	34.088	51.359	154.000	166.650	315.625	416.625	Avg WGI	10-17-22			
	50.563	109.333	176.876	269.165	389.481	416.625	Avg WGI	5-17-22			
TOTAL WGI	42.883	80.211	186.766	243.129	367.949	518.761	Avg All WGI				
TOTAL ALL	47.775	84.391	163.326	249.751	414.212	539.972	Avg All Test Series				

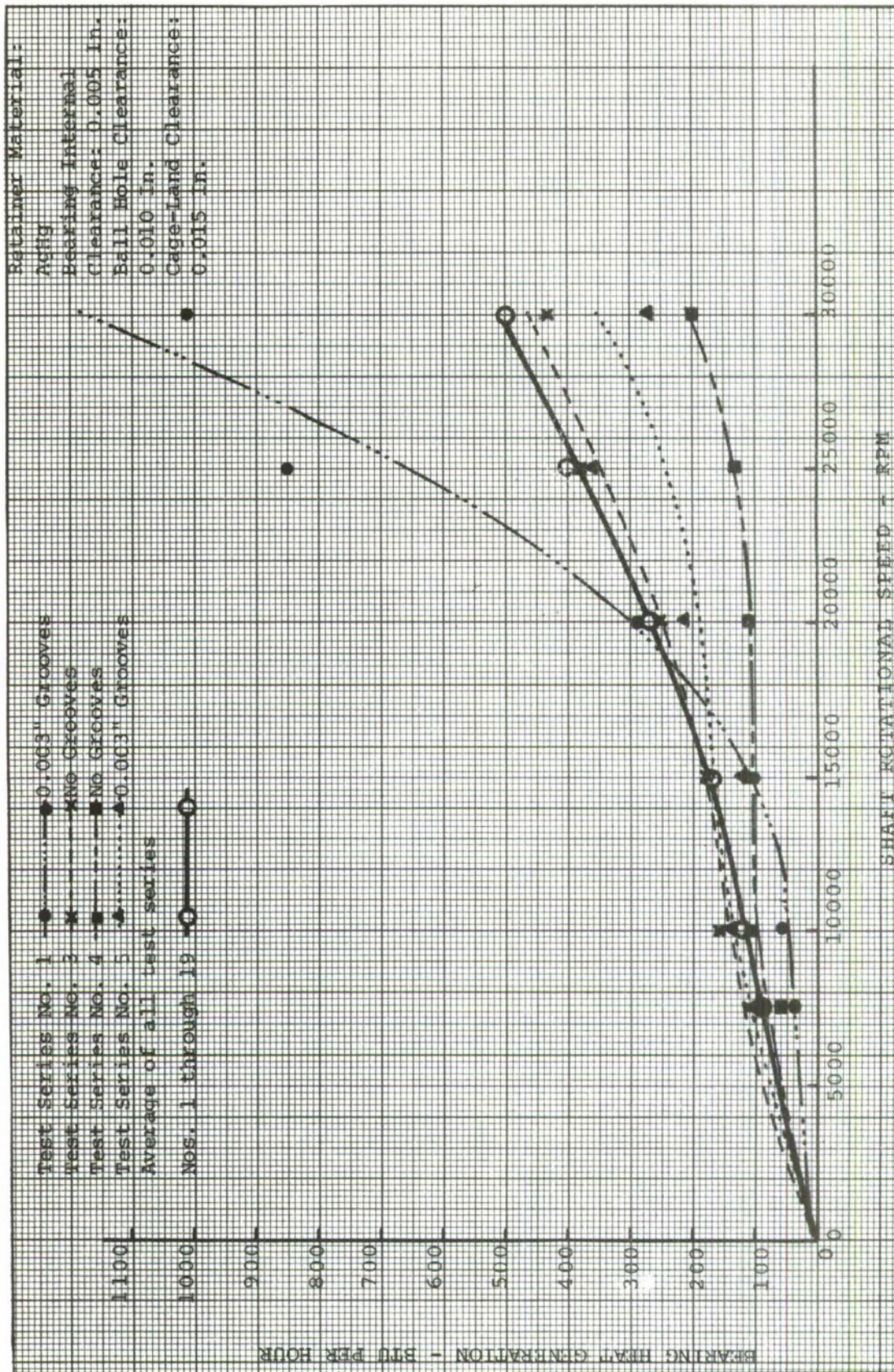


Figure 23. Bearing Heat Generation of Small Clearance AgHg Bearings
at Various Speeds

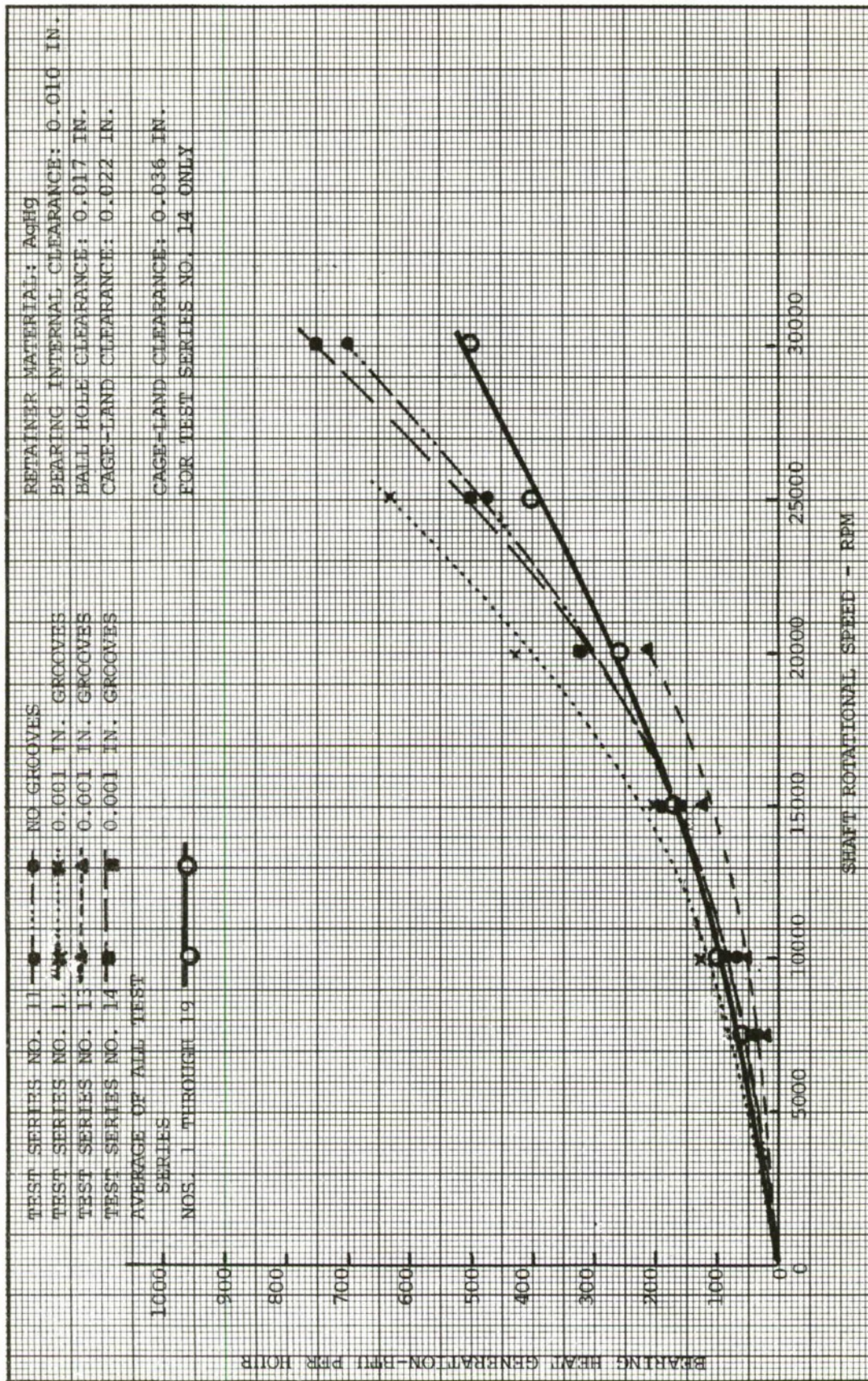


Figure 24. Bearing Heat Generation for Large Clearance AgHg Bearings at Various Speeds

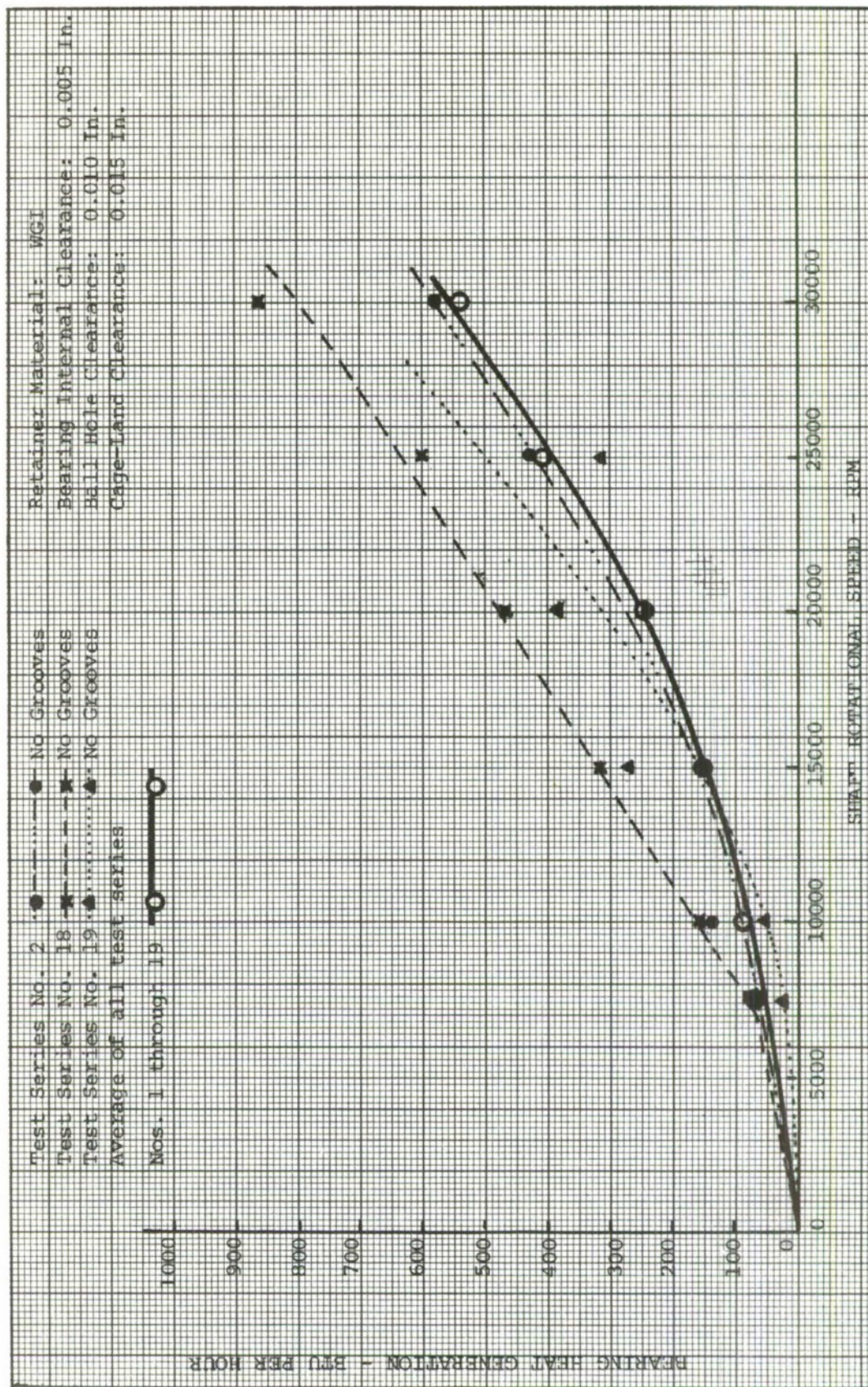


Figure 25. Bearing Heat Generation of Small Clearance WGI Bearings at Various Speeds

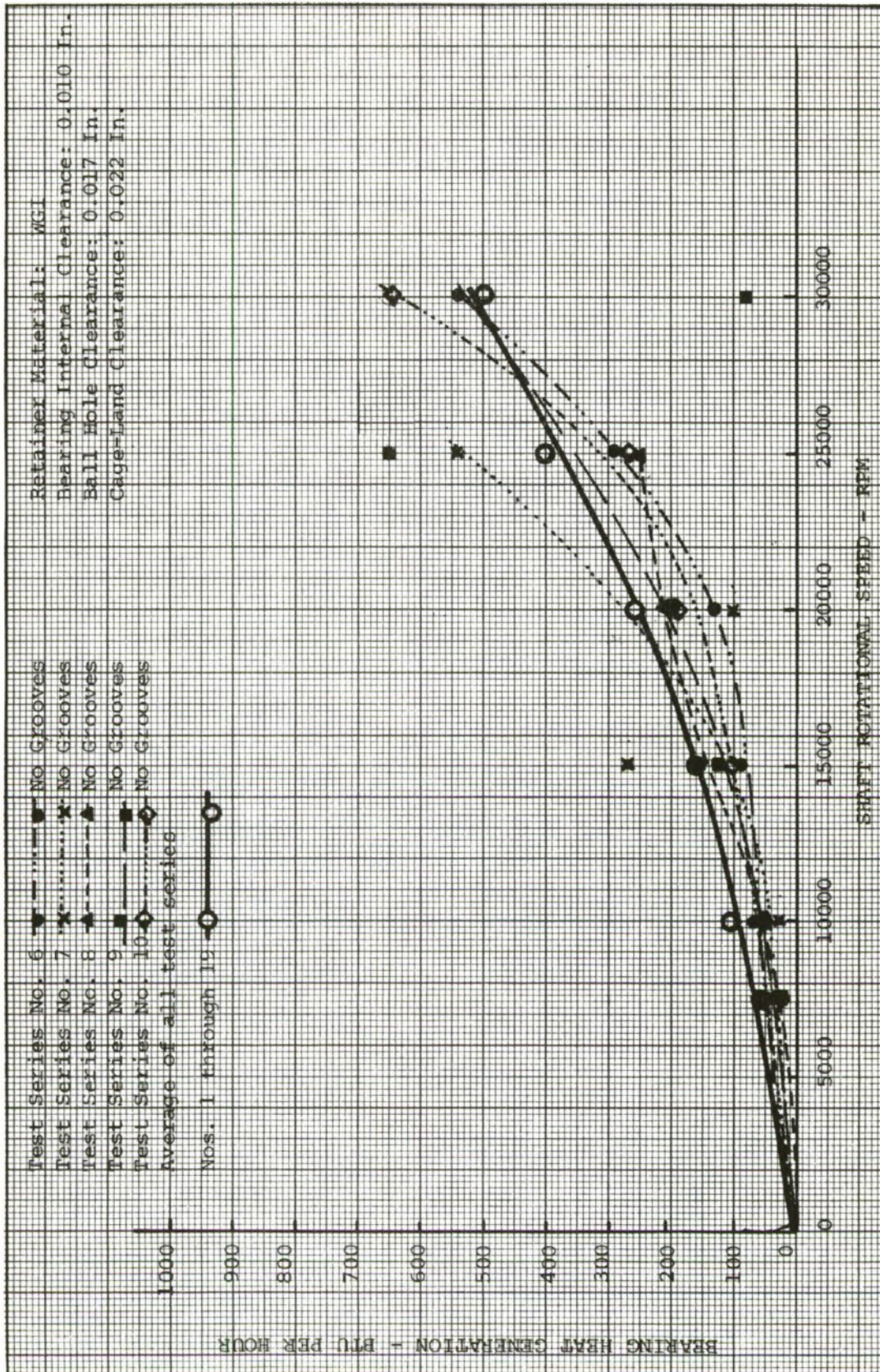


Figure 26. Bearing Heat Generation for Large Clearance WGI Bearings at Various Speeds

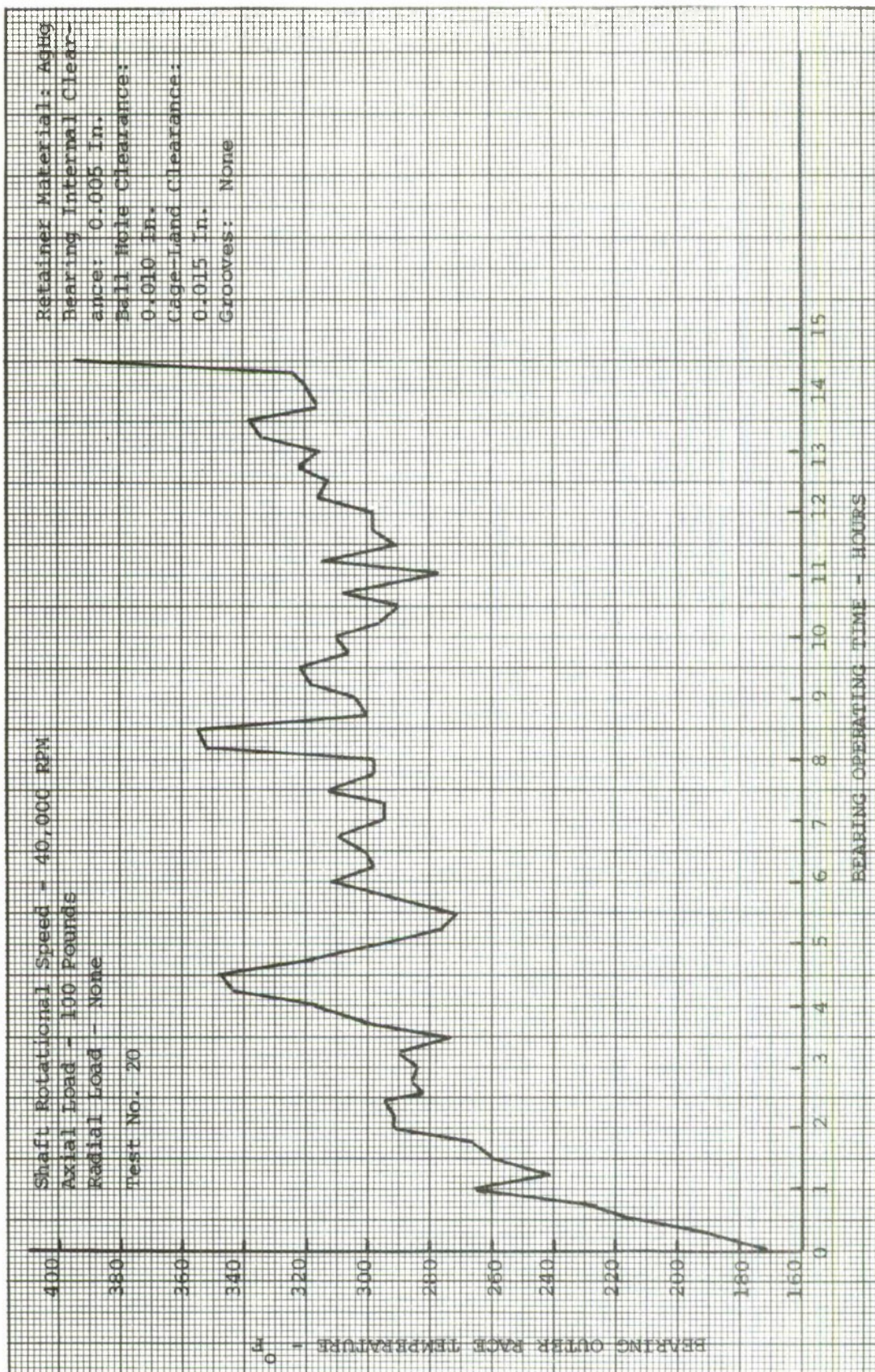


Figure 27. Variation of Bearing Outer Race Temperature with Time for AgHg Bearing Operating at 40,000 RPM

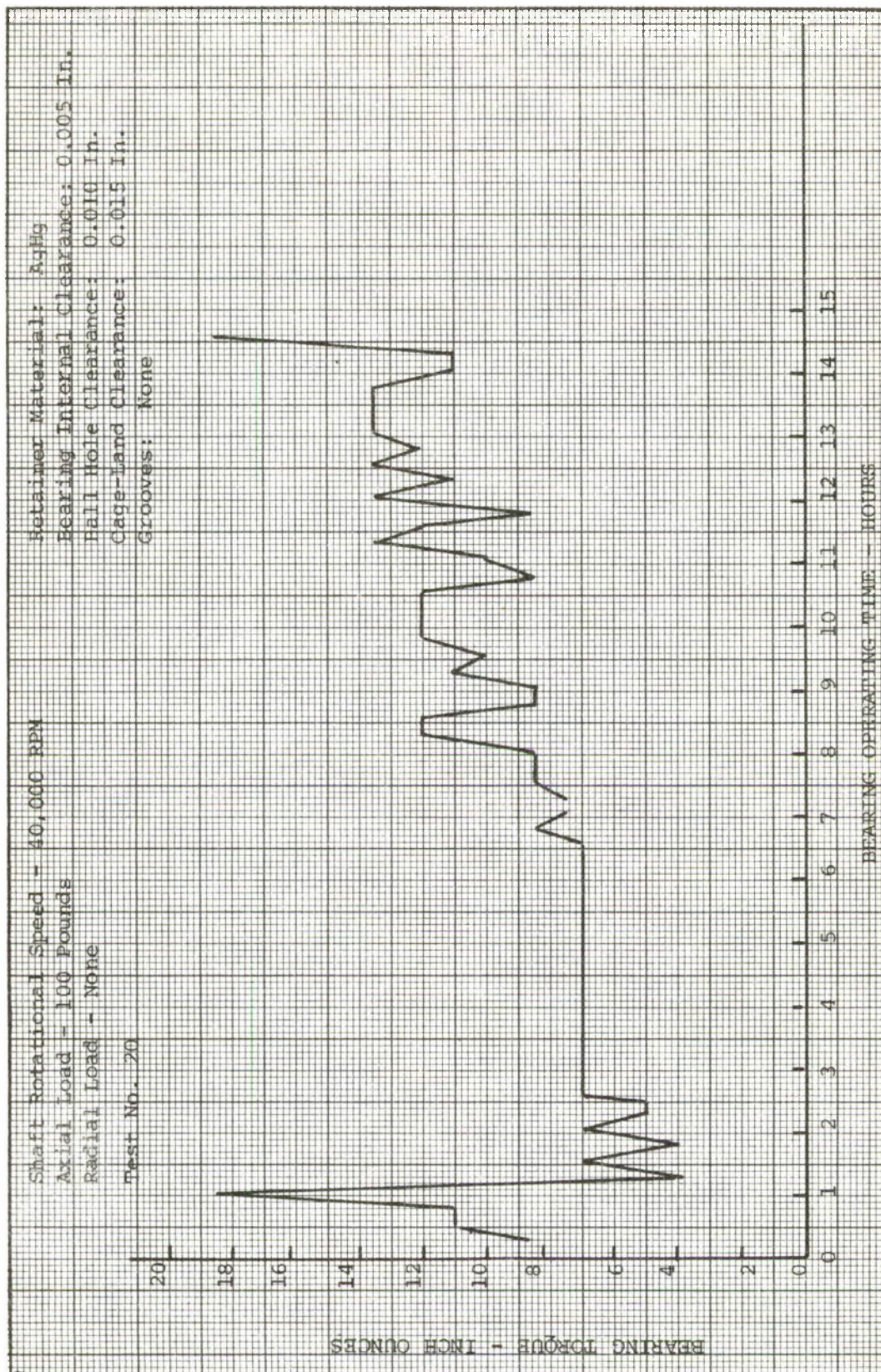


Figure 28. Variation of Bearing Torque with Time for AgHg Bearing Operating at 40,000 RPM

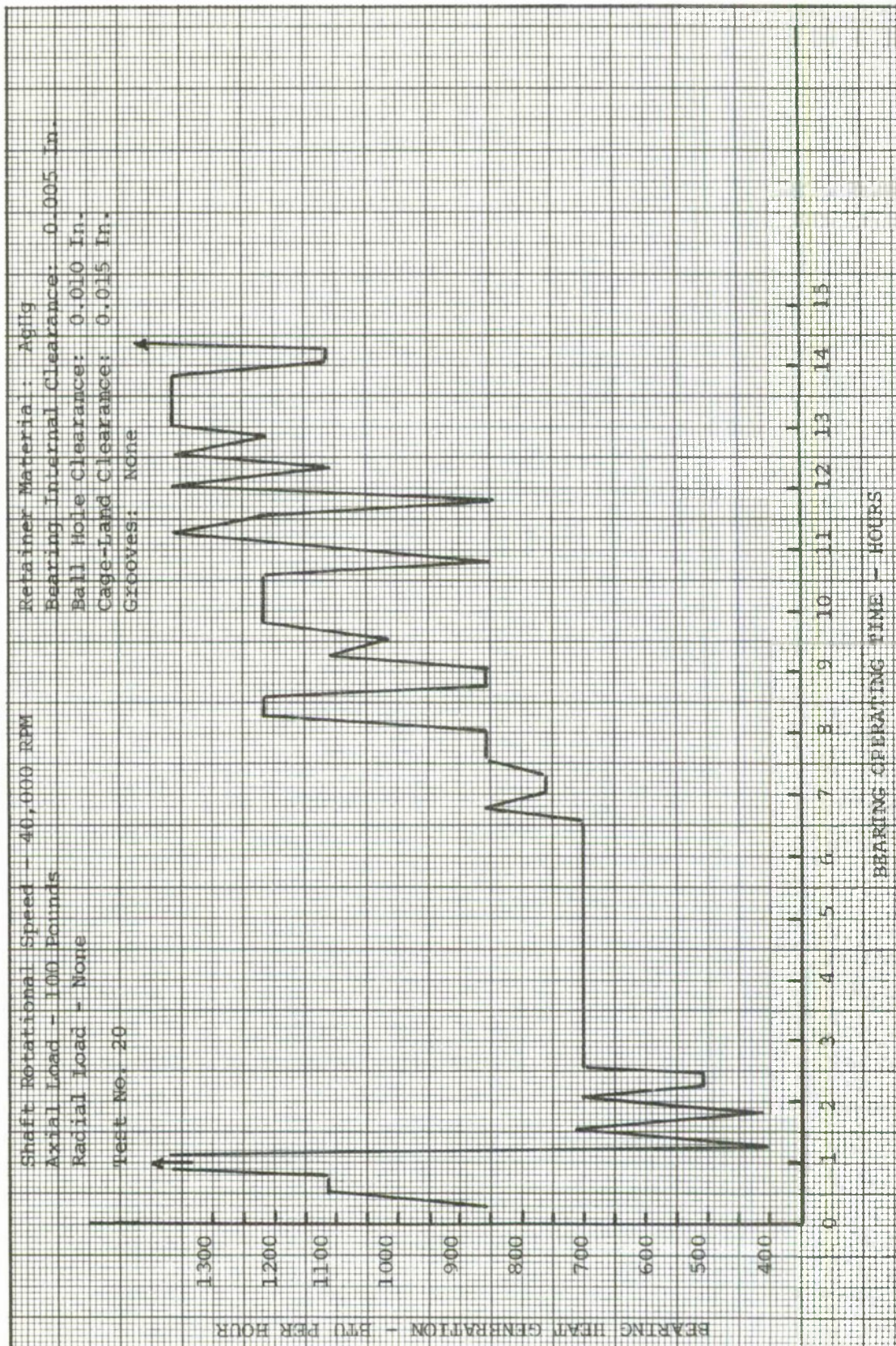


Figure 29. Variation of Bearing Heat Generation with Time for AgHg Bearing Operating at 40,000 RPM

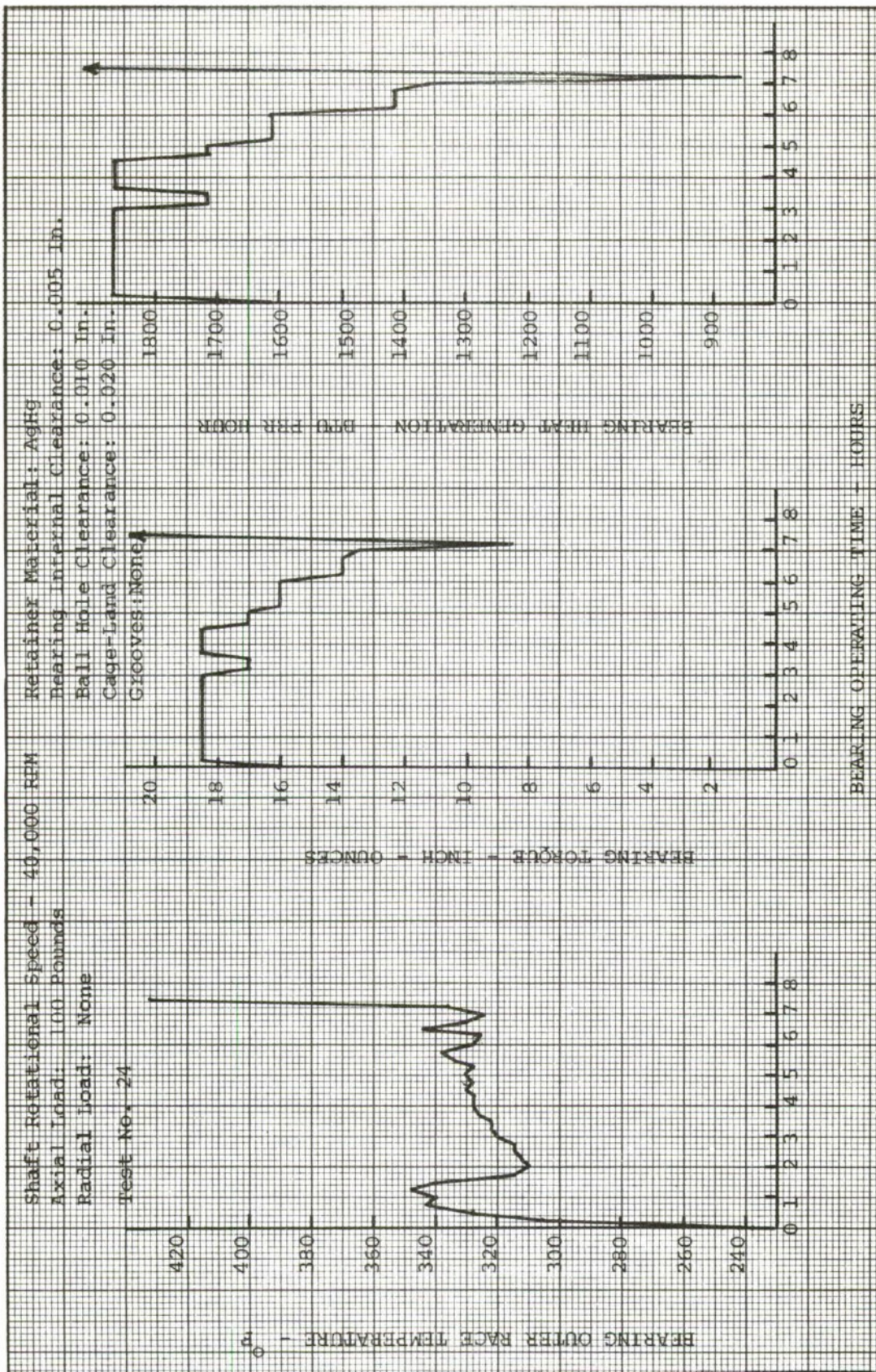


Figure 30. Variation of Bearing Outer Race Temperature, Torque and Heat Generation with Time of a AgHg Bearing Operating at 40,000 RPM

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. The attempt to determine the effectiveness of grooves in the bearing inner race lands for pumping cooling air into the bearing was unsuccessful due to bearing cage imbalance problems at the higher speed conditions.
2. Bearings with AgHg composite retainers ran cooler and with less torque than those with WGI retainers.
3. Bearing radial and axial loads had little effect upon bearing operating temperatures and torque. This is in agreement with the results of other investigators.
4. Bearing operating speed had the most predominant effect on bearing operating temperature levels and torque. This is also in agreement with other investigators.
5. Inasmuch as heat generation is a function of both operating speed and torque, the effects of speed and load upon heat generation are comparable to conclusions 3 and 4 above. This has been verified most predominantly in Ref. 1-3, 5 & 6.
6. The 14 hr, 40,000 rpm test demonstrates a potential ultra high speed operating capability for solid lubricated ball bearings.
7. Cage imbalance due partly to machining inaccuracies and partly to the relatively heavy weight of the cage materials, has been shown to be a considerable problem at high speeds.

RECOMMENDATIONS

1. Due to the imbalance problems encountered, it is recommended that future work be conducted to develop lighter weight solid lubricated retainers for use in ultra high speed applications.
2. Bearings employing AgHg or WGI cages should be dynamically balanced when their intended use involves operating speeds of 15,000 RPM or higher.

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1. Solid Lubricated Bearing Technology Part I - Solid Lubricated High Speed Ball Bearings, D. J. Boes, Westinghouse Research Laboratories, AFAPL-TR-71-69 Part I, September 1971.
2. Solid Lubricated Bearing Technology Part II - Solid Lubricated High Speed Ball Bearings, D. J. Boes, Westinghouse Research Laboratories, AFAPL-TR-71-69 Part II, December 1972.
3. Experimental Investigation of AgHg - WtFE - MoSe₂ Solid Lubricated Ball Bearings for High Speed, High Temperature and High Load Applications, Ronald D. Dayton, Midwest Research Institute, AFAPL-TR-71-100, January 1972.
4. Rolling Bearing Analysis, Tedric A. Harris, John Wiley & Sons 1966, p454.
5. High Temperature, High Speed Solid Lubricated Bearing Technology Phase I - Heat Transfer, P. R. Bissett, R. L. Downey, R. A. Solomon, AiResearch Mfg Co of Ariz., AFAPL-TR-74-77, Volume I, August 1974.
6. High Temperature, High Speed Solid Lubricated Bearing Technology, Phase II - Test and Analysis, P. R. Bissett, R. L. Downey, R. A. Solomon, AiResearch Mfg Co of Ariz., AFAPL-TR-74-77, Volume II, July 1975.

APPENDIX

TEST NO. 1 BRG NO 44 RETAINER A ₄ H ₄ INT. CL 5 MILS BALL HOLE CL 10 MILS GAGE LAND CL 15 MILS GROOVES 3 MM												
DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
21-9-73	1245	-	35	50	0	0		-	-	-	7500	
	1300	15						87	0.1	2		
	1315	30						88	0.1	2		
	1330	45						88	0.1	2		
	1330	-						-	-	-	10000	
	1345	15						95	0.1	2		
	1400	30						98	0.1	2		
	1415	45						98	0.1	2		
	1415	-						-	-	-	15000	
	1430	15						118	0.15	3		
	1435	30						123	0.2	4		
	1450	35						125	0.15	3		
	1500	45						123	0.15	3		
	1505	50						123	0.15	3		
	1505	-						-	-	-	20000	
	1515	10						149	0.25	5		
	1530	25						168	0.25	5		
	1545	40						175	0.2	7		
	1550	45						177	0.35	7.5		
	22-9-73	0745	-						-	-	-	2500
0800		15						95	0.1	2		
0815		30						95	0.1	2		
0815		-						-	-	-	10000	
0830		15						100	0.1	2		
0845		30						101	0.1	2		
0900		45						102	0.1	2		
0900		-						-	-	-	15000	
0915		15						121	0.1	2		
0930		30						128	0.1	2		
0945		45						129	0.1	2		
0945		-						-	-	-	20000	
1000		15						157	0.2	4		
1015		30						167	0.2	4		
1030		45						172	0.2	4		
1030		-						-	-	-	25000	
1045		15						272	0.6	13.5		
1030		30						298	0.6	13.5		
1045		45						332	0.6	13.5		
1100		60						350	0.6	13.5		
1100		-						-	-	-	30000	
1149		9						465	0.8	18.5		
1145		15						470	0.6	13.5		
1148		18						472	0.6	13.5		
Evidence of cage unbalance, uneven wear and ball-shoulder contact. Oil contamination present												

TEST NO 2 BRG NO 48 RETAINER WGI INT. CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GRIFFES NO													
DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED	REMARKS	
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM		
23-7-74	1500	—	43	75	0	0	76	88	+0.1	2	7500		
	1515	15					76	88	+0.1	2	↓		
	1545	—					87	96	-0.5	11	10000		
	1500	15					84	94	-0.5	11	↓		
	1500	—					105	109	+0.5	11	15000		
	1515	15					104	102	+0.5	11	↓		
	1530	30					103	98	+0.5	11	↓		
	1545	45					103	98	+0.5	11	↓		
	1700	—					—	—	—	—	20000		
	1715	15					127	118	-0.2	4	↓		
	1730	30					129	124	-0.2	4	↓		
	1745	45					127	124	-0.2	4	↓		
	1115	—					163	152	-0.2	4	25000		
	1130	15					157	140	-0.2	4	↓		
	1145	30					157	140	-0.2	4	↓		
24-7-74	1045	—					191	174	-0.3	7	30000		
	1100	15					191	174	-0.3	7	↓		
	0840	—	51	100	0	0	—	—	—	—	7500		
	1000	20					93	91	+0.1	2	↓		
	1010	30					93	91	+0.1	2	↓		
	1020	—					—	—	—	—	10000		
	1020	10					103	104	+0.1	2	↓		
	1030	20					104	104	+0.1	2	↓		
	1030	—					—	—	—	—	15000		
	1045	15					131	120	+0.25	5	↓		
	1100	30					131	120	+0.25	5	↓		
	1100	—					—	—	—	—	20000		
	1115	15					157	140	-0.2	4	↓		
	1130	30					166	149	-0.2	4	↓		
	1145	45					168	150	-0.1	2	↓		
23-7-74	0845	—					—	—	—	—	25000		
	0900	15					146	132	-0.2	4	↓		
	0915	30					145	130	-0.2	4	↓		
	0915	—					—	—	—	—	30000		
	0930	15					170	148	-0.3	7	↓		
	0945	30					177	156	-0.3	7	↓		
	1000	45					178	160	-0.3	7	↓		
	1015	60					191	168	-0.2	4	↓		
	1030	75					199	172	-0.3	7	↓		
	1045	90					192	170	-0.3	7	↓		
	0830	—	59	125	0	0	—	—	—	—	7500		
	0845	15					87	96	-0.2	4	↓		
	0900	30					85	94	-0.2	4	↓		
	0900	—					—	—	—	—	10000		
	0915	15					91	98	-0.2	4	↓		
	0930	30					91	98	-0.2	4	↓		
24-7-74	0930	—					—	—	—	—	15000		
	0945	15					110	110	-0.15	3	↓		
	1000	30					110	110	-0.15	3	↓		
	1000	—					—	—	—	—	20000		
	1015	15					124	118	-0.1	2	↓		
	1030	30					126	120	-0.1	2	↓		
	1045	45					126	120	-0.1	2	↓		
	1045	—					137	124	-0.2	4	25000		
	1100	15					137	124	-0.2	4	↓		
	1100	—					—	—	—	—	30000		
	1115	15					192	160	-0.3	7	↓		
	1130	30					192	164	-0.3	7	↓		
	1300	—	67	150	0	0	—	—	—	—	7500		
	1315	15					88	94	-0.3	7	↓		
	1330	30					88	94	-0.3	7	↓		
	1330	—					—	—	—	—	10000		
24-7-74	1335	5					97	100	-0.3	7	↓		
	1345	15					98	102	-0.2	4	↓		
	1350	20					96	100	-0.3	7	↓		
	1350	—					—	—	—	—	15000		
	1400	10					117	113	0.2	4	↓		
	1410	20					118	116	0.2	4	↓		
	1420	30					118	118	0.2	4	↓		
	1420	—					—	—	—	—	20000		

TEST NO 2 BRG. NO 48 RETAINER WGT INT. CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GRINDS NO.

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
24-7-74	1430	10	67	150	0	0	130	124	-0.3	7	20000	
	1440	20					129	123	-0.3	7		
	1450	30					129	123	-0.3	7		
	1450	-									25000	
	1500	10					138	125	-0.2	4		
	1510	20					143	126	-0.2	4		
	1520	30					143	128	-0.2	4		
	1520	-					179	160	-0.2	4	30000	
	1540	20					184	170	-0.2	4		
	1550	30					184	170	-0.2	4		
	0945	-	67	150	8	25					7500	
	1000	15					87	94	-0.2	4		
25-7-74	1010	25					85	94	-0.2	4		
	1010	-									10000	
	1020	10					90	97	-0.2	4		
	1030	20					90	98	-0.2	4		
	1030	-									15000	
	1040	10					101	102	-0.1	2		
	1050	20					102	102	0	0		
	1050	-									20000	
	1100	10					127	118	-0.2	4		
	1105	15					128	122	-0.2	4		
	1115	25					128	122	-0.2	4		
	1250	-									25000	
5-8-74	1305	15					205	164	-0.7	16		
	1315	25					225	184	-0.7	16		
	1325	35					225	190	-0.7	16		
	1330	40					225	190	-0.7	16		
	1330	-									30000	
	1335	5					261	210	-0.6	13.5		
	1345	15					268	210	-0.7	16		
	1350	20					275	220	-0.7	16		
	1355	25					287	228	-0.6	13.5		
	1400	30					285	228	-	-		
	0910	-	67	150	16	50	138	151	-0.25	5	7500	
	0920	10					128	138	-0.25	5		
6-8-74	0930	20					126	131	-0.25	5		
	0940	30					121	126	-0.25	5		
	0950	40					121	126	-0.25	5		
	0850	-							-0.4	8.5	10000	
	0900	10					163	168	-0.4	9.5		
	0910	20					163	165	-0.45	10		
	0820	-									15000	
	0830	10					153	140	-0.1	2		
	0840	20					220	190	-0.15	3		
	0850	30					215	200	-0.15	3		
	1510	-									20000	
	1515	5					214	194	-0.9	20.5		
5-8-74	1525	15					214	190	-0.9	20.5		
	1530	20					214	189	-0.9	20.5		
	1440	-									25000	
	1445	5					246	206	-0.6	13.5		
	1500	20					248	208	-0.6	13.5		
	1510	30					248	206	-	-		
	1400	-					232	202	-0.4	8.5	30000	
	1410	10					220	190	-0.5	11		
	1420	20					225	192	-0.5	11		
	1430	30					224	208	-0.65	12.5		
	1440	40					224	196	-0.4	8.5		
	0950	-	67	150	24	75					7500	
6-8-74	1000	10					94	112	-0.1	2		
	1005	15					84	104	-0.1	2		
	1010	20					85	104	-0.1	2		
	1010	-					53	100	-0.05	1	10000	
	1020	10					93	100	-0.05	1		
	1020	-					118	112	0	0	15000	
	1030	10					124	120	0	0		
	1040	20					125	122	0.05	1		
	1050	30					126	122	0.05	1		
	1050	-					150	130	-0.35	7.5	20000	

TEST NO 2 BRG. NO 48 RETAINER WGI INT. CL 5 MILS BALL HOLE CL 10 MILS GAGE-LAND CL 15 MILS GRINDS NO

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM	
6-8-74	1100	10	67	150	24	75	160	144	-0.35	7.5	2000	
	1115	25					162	147	-0.4	8.5		
	1125	35					162	148	-0.4	8.5		
	1310	-					-	-	-	-	2500	
	1320	10					210	175	+0.1	2		
	1330	20					250	196	+0.1	2		
	1335	25					251	196	+0.1	2		
	1335	-					-	-	-	-	3000	
	1340	5					293	230	+0.2	4		
	1345	10					340	282	+0.2	4		High IA Temp. - Stopped

Oil Found on Test bearing. Ball-shroud contact had occurred. Lubricant gone in ball pocket

TEST NO 3 BRG. NO 49 RETRAINER A₉H₉ INT. CL 5 MILS BALL HOLE CL 10 MILS GAGE LAND CL 15 MILS GROOVES NO

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
8-8-74	1245	-	43	75	0	0	-	-	-	-	7500	
	1300	15					93	92	-0.1	2		
	1310	25					88	89	-0.1	2		
	1310	-					-	-	-	-	10000	
	1320	10					93	90	-0.05	1		
	1330	20					93	90	-0.05	1		
	1330	-					-	-	-	-	15000	
	1340	10					102	96	-0.05	1		
	1400	30					102	98	-0.05	1		
	1410	40					102	98	-0.05	1		
	1410	-					-	-	-	-	20000	
	1420	10					123	112	+0.05	1		
	1430	20					123	112	+0.05	1		
	1430	-					-	-	-	-	25000	
	1440	10					140	124	0	0		
	1450	20					142	126	0	0		
	1500	30					143	128	0	0		
	1500	-					175	150	-0.1	2	30000	
	1515	15					182	158	-0.1	2		
	1530	30					172	158	-0.1	2		
9-8-74	0810	-	51	100	0	0	-	-	-	-	7500	
	0820	10					92	99	-0.3	7		
	0830	20					93	98	-0.3	7		
	0840	30					88	94	-0.3	7		
	0840	-					-	-	-	-	10000	
	0855	15					91	91	-3	7		
	0910	30					89	91	-0.35	7.5		
	0920	40					89	91	-0.35	7.5		
	0920	-					-	-	-	-	15000	
	0930	10					107	102	-0.4	8.5		
	0940	20					104	102	-0.4	8.5		
	0950	30					104	102	-0.4	8.5		
	0950	-					-	-	-	-	20000	
	1000	10					114	104	-0.4	8.5		
	1010	20					114	104	-0.4	8.5		
	1010	-					-	-	-	-	25000	
	1020	10					133	114	-0.45	10		
	1030	20					133	116	-0.45	10		
	1030	-					-	-	-	-	30000	
	1045	15					173	149	-0.5	11		
	1100	30					173	150	-0.5	11		
9-8-74	1300	-	59	125	0	0	93	94	-0.3	7	7500	
	1310	10					94	94	-0.3	7		
	1310	-					-	-	-	-	10000	
	1320	10					94	98	-0.3	7		
	1330	20					94	97	-0.3	7		
	1330	-					-	-	-	-	15000	
	1340	10					112	108	-0.2	4		
	1350	20					112	108	-0.2	4		
	1350	-					-	-	-	-	20000	
	1400	10					118	108	-0.3	7		
	1410	20					118	108	-0.3	7		
	1410	-					-	-	-	-	25000	
	1420	10					138	117	-0.35	7.5		
	1430	20					142	121	-0.35	7.5		
	1440	30					142	122	-0.35	7.5		
	1440	-					-	-	-	-	30000	
	1450	10					182	154	-0.45	10		
	1510	30					183	156	-0.45	10		
	1520	40					183	156	-0.45	10		
10-8-74	0800	-	67	150	0	0	98	98	-0.4	8.5	7500	
	0810	10					99	95	-0.4	8.5		
	0820	20					94	94	-0.4	8.5		
	0820	-					-	-	-	-	10000	
	0830	10					95	96	-0.35	7.5		
	0840	20					93	94	-0.35	7.5		
	0850	30					94	96	-0.35	7.5		
	0850	-					-	-	-	-	15000	
	0900	10					104	100	-0.35	7.5		
	0910	20					103	100	-0.35	7.6		

TEST NO 3 BRG NO 49 RETAINER A₁H₁ INT. CL 5 MILS BALL HOLE CL 10 MILS CAGE-LAND CL 15 MILS GRINDS 110

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE	SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING IN-OZ	RPM	
11-8-74	0910	- 70	67	150	0	0	-	-	-	2000	
	0920	10					118	106	-0.4	8.5	
	0930	20					119	108	-0.4	8.5	
	0940	30					120	108	-0.4	8.5	
	0940	-					-	-	-	2500	
	0950	10					144	122	-0.4	8.5	
	1005	25					146	125	-0.4	8.5	
	1015	35					147	126	-0.4	8.5	
	1030	50					147	126	-	-	
	1030	-					-	-	-	3000	
	1040	10					175	142	-0.5	11	
	1050	20					180	149	-0.5	11	
	1100	30					180	149	-0.5	11	
12-8-74	1300	-	67	150	8	25	91	96	-0.1	2	7500
	1310	10					88	90	-0.1	2	
	1310	-					-	-	-	10000	
	1320	10					92	98	-0.1	2	
	1330	20					92	98	-0.1	2	
	1330	-					-	-	-	15000	
	1340	10					99	102	-0.05	1	
	1350	20					99	102	-0.05	1	
	1350	-					-	-	-	20000	
	1400	10					119	111	-0.05	1	
	1410	20					120	113	-0.05	1	
	1420	30					120	114	-0.05	1	
	1420	-					-	-	-	25000	
	1430	10					139	122	-0.15	3	
	1440	20					140	126	-0.15	3	
	1450	30					140	126	-0.15	3	
	1450	-					-	-	-	30000	
	1500	10					166	142	-0.2	4	
13-8-74	1510	20					172	147	-0.2	4	
	1520	30					174	151	-0.2	4	
	1530	40					174	151	-0.2	4	
	0830	-	67	150	16	50	93	101	-0.1	2	7500
	0840	10					93	101	-0.1	2	
	0840	-					-	-	-	10000	
	0850	10					94	102	-0.1	2	
	0900	20					94	102	-0.1	2	
	0900	-					-	-	-	15000	
	0910	10					101	104	-0.1	2	
	0920	20					102	104	-0.1	2	
	09	-					-	-	-	20000	
	0930	10					121	114	-0.15	3	
	0940	20					121	114	-0.15	3	
	0950	30					121	115	-0.15	3	
	0950	-					-	-	-	25000	
	1000	10					136	124	-0.15	3	
	1015	25					140	128	-0.15	3	
13-8-74	1030	40					140	129	-0.15	3	
	1030	-					-	-	-	30000	
	1045	15					162	143	-0.2	4	
	1100	30					164	148	-0.2	4	
	1115	45					164	148	-0.2	4	
	1300	-	67	150	24	75	92	100	-0.25	5	7500
	1310	10					90	98	-0.25	5	
	1320	20					90	98	-0.25	5	
	1320	-					-	-	-	10000	
	1330	10					94	100	-0.3	7	
	1340	20					94	100	-0.3	7	
	1340	-					-	-	-	15000	
	1350	10					115	114	-0.3	7	
	1400	20					116	116	-0.3	7	
	1410	30					116	117	-0.3	7	
	1410	-					-	-	-	20000	
	1420	10					122	116	-0.35	7.5	
	1430	20					124	118	-0.35	7.5	
	1440	30					124	118	-0.35	7.5	
	1440	-					-	-	-	25000	
	1450	10					134	126	-0.35	7.5	

TEST NO 3 BRG. NO 49 RETAINER A₁H₂ INT. CL 5 MILS BALL HOLE CL 1A MILS GAGE LAND CL 15 MILS GROOVES 1A

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
13-8-74	1500	20	67	150	24	75	140	128	-0.35	7.5	25000	
	1510	30					140	128				
	1510										30000	
	1520	10					167	147	-0.4	8.5		
	1530	20					168	152	-0.4	8.5		
	1540	30					168	152	-0.4	8.5		
14-8-74	0800	-	43	75	0	0	90	93	-0.1	2	7500	
	0810	10					88	95	-0.1	2		
	0820	20					84	90	-0.1	2		
	0830	30					84	90	-0.1	2		
	0830										10000	
	0840	10					90	96	-0.15	3		
	0850	20					90	96	-0.15	3		
	0850										15000	
	0900	10					104	104	-0.2	4		
	0910	20					104	104	-0.2	4		
	0910										20000	
	0920	10					129	115	-0.05	1		
	0930	20					127	119	0	0		
	0940	30					128	122	-0.05	1		
	0950	40					128	122	-0.05	1		
	0950										25000	
	1000	10					141	128	-0.2	4		
	1010	20					141	129	-0.2	4		
	1020	30					141	129	-0.2	4		
	1020										30000	
	1120						166	130	+0.3	7		
	1130	10					173	144	+0.25	5		
	1140	20					175	145	+0.25	5		
	1150	30					175	145	+0.25	5		
21-8-74	1300	-	43	75	8	25	89	95	+0.25	5	7500	
	1310	10					84	94	+0.3	7		
	1320	20					84	93	+0.3	7		
	1320										10000	
	1340	20					84	92	+0.4	8.5		
	1400	40					84	92	+0.4	8.5		
	1400										15000	
	1410	10					94	98	+0.2	4		
	1420	20					94	98	+0.2	4		
	1420										20000	
	1430	10					109	106	+0.1	2		
	1440	20					113	108	+0.3	7		
	1500	40					113	108	+0.3	7		
	1500						133	120	+0.2	4	25000	
	1510	10					133	122	+0.2	4		
	1520	20					133	122	+0.2	4		
	1520						159	138	-0.6	13.5	30000	
	1530	10					166	146	-0.6	13.5		
	1540	20					166	146	-0.6	13.5		
22-8-74	1445	-	43	75	16	50	88	94	+0.5	11	7500	
	1455	10					84	94	+0.6	13.5		
	1505	20					82	92	+0.6	13.5		
	1515	30					82	92	+0.6	13.5		
	1515						83	92	+0.6	13.5	10000	
	1525	10					83	92	+0.6	13.5		
	1525										15000	
	1535	10					98	96	+0.5	11		
	1545	20					95	98	+0.5	11		
	1550	25					95	98	+0.5	11		
23-8-74	0745	-					122	114	+0.3	7	20000	
	0755	10					118	114	+0.3	7		
	0805	20					118	114	+0.3	7		
	0805										25000	
	0815	10					137	122	+0.3	7		
	0825	20					140	128	+0.3	7		
	0835	30					140	128	+0.3	7		
	0835										30000	
	0845	10					165	144	+0.2	4		
	0855	20					167	148	+0.2	4		
	0905	30					168	150	+0.2	4		

TEST NO 3 BRG NO 49 RETAINER A₁₁ INT. CL 5 MILS BALL HOLE CL 10 MILS GAGE LAND CL 15 MILS GREYES NO.

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
23-8-74	0915	40	43	75	16	50	170	151	+0.2	4	3000	
	0925	50					169	151	+0.15	3		
23-8-74	1145	-	43	75	24	75	88	102	+0.5	11	7500	
	1155	10					84	98	+0.5	11		
	1200	20					84	98	+0.5	11		
	1120	-							-	-	10000	
	1125	5					98	108	+0.6	13.5		
	1135	15					97	108	+0.6	13.5		
	1145	25					97	108	+0.6	13.5		
	1050	-							-	-	15000	
	1100	10					116	120	+0.3	7		
	1110	20					102	118	+0.3	7		
	1120	30					102	118	+0.3	7		
	1030	-							-	-	20000	
	1040	10					131	128	+0.2	4		
	1050	20					131	128	+0.2	4		
	0955	-							-	-	25000	
	1000	5					141	134	+0.3	7		
	1010	15					138	132	+0.3	7		
	1020	25					138	130	+0.3	7		
	1030	35					138	130	+0.3	7		
	0925	-							-	-	30000	
	0935	10					163	150	+0.15	3		
	0945	20					163	150	+0.15	3		
	0955	30					163	150	+0.15	3		
12-9-74	0800	-	51	100	8	25	88	92	+0.1	2	7500	
	0810	10					82	90	+0.2	4		
	0820	20					81	90	+0.2	4		
	0820	-							-	-	10000	
	0830	10					86	92	0.1	2		
	0840	20					86	92	0.1	2		
	0840	-							-	-	15000	
	0850	10					93	96	+0.2	4		
	0900	20					93	98	+0.2	4		
	0910	30					93	97	+0.2	4		
	0910	-							-	-	20000	
	0920	10					109	106	+0.5	11		
	0930	20					111	109	+0.5	11		
	0940	30					111	107	+0.5	11		
	0940	-							-	-	25000	
	0950	10					122	116	-0.7	16		
	1000	20					124	118	-0.7	16		
	1010	30					124	118	-0.7	16		
	1010	-							-	-	30000	
	1020	10					161	150	-0.05	1		
	1030	20					165	156	-0.05	1		
	1040	30					167	159	-0.05	1		
	1050	40					167	159				
12-9-74	1250	-	51	100	16	50	86	92	+0.1	2	7500	
	1300	10					82	87	+0.1	2		
	1310	20					82	87	+0.1	2		
	1310	-							-	-	10000	
	1320	10					85	92	+0.2	4		
	1330	20					84	90	+0.2	4		
	1340	30					84	90	+0.2	4		
	1340	-							-	-	15000	
	1350	10					94	95	+0.1	2		
	1400	20					94	96	+0.1	2		
	1400	-							-	-	20000	
	1410	10					105	104	0	0		
	1420	20					107	108	0	0		
	1430	30					107	108	0	0		
	1430	-							-	-	25000	
	1440	10					123	118	+0.1	2		
	1450	20					123	118	+0.1	2		
	1500	30					123	118	+0.1	2		
	1500	-							-	-	30000	
	1510	10					148	138	+0.05	1		
	1520	20					154	146	+0.05	1		
	1530	30					154	146	+0.05	1		

TEST NO 3 BRG. NO 49 RETAINER A ₉ H ₉ INT. CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GROUND NO												
DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
13-9-74	0745	-	51	100	24	75	92	96	+0.2	4	7500	
	0755	10					89	96	+0.2	4		
	0805	20					88	96				
	0805	-					-	-	-	-	10000	
	0810	5					93	98	+0.3	7		
	0820	15					92	98	+0.3	7		
	0820	-					-	-	-	-	15000	
	0830	10					101	102	+0.1	2		
	0840	20					101	103	+0.1	2		
	0840	-					-	-	-	-	20000	
	0850	10					110	108	-0.1	2		
	0900	20					110	110	-0.1	2		
	0910	30					115	112	-0.1	2		
	0920	40					115	112	-0.1	2		
	0920	-					-	-	-	-	25000	
	0930	10					127	122	+0.15	3		
	0940	20					129	125	+0.15	3		
	0950	30					129	126	+0.15	3		
	0950	-					-	-	-	-	30000	
	1000	10					163	152	0	0		
	1010	20					165	156	0	0		
	1220	30					165	156	0	0		

TEST No 4 BRG. NO 49 RETAINER ARM INTCL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GROOVES No.

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
19-9-74	0800	-	43	75	0	0		88	-0.05	1	7500	
	0810	10						88	0	0	↓	
	0810	-						-	-	-	10000	
	0820	10						88	+0.1	2		
	0830	20						88	+0.1	2	↓	
	0830	-						-	-	-	15000	
	0840	10						92	+0.1	2		
	0850	20						93	+0.1	2	↓	
	0850	-						-	-	-	20000	
	0900	10						102	0	0		
	0910	20						104	-0.05	1		
	0920	30						106	-0.05	1		
	0930	40						106	-0.05	1	↓	
	0930	-						-	-	-	25000	
	0940	10						114	0	0		
	0950	20						115	0	0		
	1000	30						115	0	0	↓	
	1000	-						-	-	-	30000	
	1010	10						136	+0.05	1		
	1020	20						148	+0.05	1		
	1030	30						148	+0.05	1	↓	
20-9-74	0755	-	43	75	8	25		90	-0.05	1	7500	
	0805	10						90	-0.05	1	↓	
	0805	-						-	-	-	10000	
	0815	10						90	+0.05	1		
	0825	20						90	+0.05	1	↓	
	0825	-						-	-	-	15000	
	0835	10						95	0	0		
	0845	20						97	0	0		
	0855	30						97	0	0	↓	
	0855	-						-	-	-	20000	
	0905	10						106	0	0		
	0915	20						108	0	0		
	0925	30						108	0	0	↓	
	0925	-						-	-	-	25000	
	0935	10						118	-0.05	1		
	0945	20						120	-0.05	1		
	0955	30						122	-0.1	2		
	1005	40						122	-0.1	2	↓	
	1005	-						-	-	-	30000	
	1015	10						134	-0.3	7		
	1025	20						142	-0.3	7		
	1035	30						142	-0.3	7	↓	
2-10-74	0835	-	43	75	16	50		74	+0.15	3	7500	
	0845	10						74	+0.15	3	↓	
	0845	-						-	-	-	10000	
	0855	10						76	+0.3	7		
	0905	20						76	+0.3	7	↓	
	0905	-						-	-	-	15000	
	0915	10						83	+0.1	2		
	0925	20						84	+0.1	2	↓	
	0925	-						-	-	-	20000	
	0935	10						95	+0.05	1		
	0945	20						96	+0.05	1		
	0955	30						96	+0.05	1	↓	
	0955	-						-	-	-	25000	
	1005	10						104	+0.05	1		
	1015	20						106	+0.05	1		
	1025	30						106	+0.05	1	↓	
	1025	-						-	-	-	30000	
	1035	10						117	+0.05	1		
	1045	20						124	+0.05	1		
	1055	30						124	+0.05	1	↓	
2-10-74	1255	-	43	75	24	75		74	+0.3	7	7500	
	1305	10						76	+0.3	7		
	1315	20						76			↓	
	1315	-						-	-	-	10000	
	1325	10						78	+0.	7		
	1335	20						79	+0.	7		
	1345	30						79	+0.	7	↓	

TEST NO. 4 BRG NO 49 RETAINER A ₉ H ₉ INT. CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GREYES NO.												
DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
2-10-74	1345	—	43	75	24	75	—	—	—	—	15000	
	1355	10						84	+0.3	7		
	1405	20						87	+0.3	7		
	1415	30						87	+0.3	7		
	1415	—						—	—	—	20000	
	1425	10						98	+0.2	4		
	1435	20						102	+0.2	4		
	1445	30						102	+0.2	4		
	1445	—						—	—	—	25000	
	1455	10						120	+0.2	1		
	1505	20						114	+0.2	4		
	1510	25						114	+0.2	4		
	1510	—						—	—	—	30000	
	1515	5						140	+0.2	4		
	1525	15						144	+0.2	4		
	1535	25						144	+0.2	4		
2-10-74	0750	—	67	150	8	25		77	+0.1	2	7500	
	0800	10						80	+0.1	2		
	0810	20						80	+0.1	2		
	0810	—						—	—	—	10000	
	0820	10						86	+0.2	4		
	0830	20						86	+0.2	4		
	0830	—						—	—	—	15000	
	0840	10						92	+0.1	2		
	0850	20						92	+0.1	2		
	0850	—						—	—	—	20000	
	0900	10						101	0	0		
	0910	20						102	+0.1	2		
	0920	30						102	+0.1	2		
	0920	—						—	—	—	25000	
	0930	10						121	+0.05	1		
	0940	20						126	+0.05	1		
	1000	40						128	+0.05	1		
	1010	50						128	+0.05	1		
	1010	—						—	—	—	30000	
	1020	10						144	0	0		
	1030	20						146	0	0		
	1040	30						146	0	0		
2-10-74	1250	—	67	150	16	50		88	+0.25	5	7500	
	1300	10						89	+0.25	5		
	1300	—						—	—	—	10000	
	1310	10						93	+0.2	4		
	1320	20						93	+0.2	4		
	1320	—						—	—	—	15000	
	1330	10						100	+0.2	4		
	1340	20						102	+0.2	4		
	1350	30						102	+0.2	4		
	1350	—						—	—	—	20000	
	1400	10						107	+0.1	2		
	1410	20						109	+0.1	2		
	1420	30						109	—	—		
	1420	—						—	—	—	25000	
	1430	10						124	+0.15	3		
	1440	20						128	+0.15	3		
	1450	30						128	+0.15	3		
	1450	—						—	—	—	30000	
	1500	10						144	+0.1	2		
	1510	20						150	+0.1	2		
	1520	30						150	+0.1	2		
4-10-74	0830	—	67	150	24	75		—	—	—	7500	
	0840	10						93	+0.2	4		
	0850	20						92	+0.2	4		
	0850	—						—	—	—	10000	
	0900	10						93	+0.3	7		
	0910	20						93	+0.3	7		
	0910	—						—	—	—	15000	
	0920	10						99	+0.2	4		
	0930	20						102	+0.2	4		
	0940	30						102	+0.2	4		
	0940	—						—	—	—	20000	

TEST NO 4 BRG. NO 49 RETAINER A ₉ H ₉ INT. CL 5 MILS BALL HOLE CL 10 MILS CAGE-LAND CL 15 MILS GRINDS NO.												
DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
9-10-74	0950	10	67	150	24	75		112	+0.15	3	20000	
	1000	20						114	+0.15	3		
	1010	30						114	+0.15	3		
	1010	-						-	-	-	25000	
	1020	10						124	+0.15	3		
	1030	20						129	+0.15	3		
	1040	30						132	+0.15	3		
	1050	40						132	+0.15	3		
	1050	-						-	-	-	30000	
	1100	10						148	+0.1	2		
	1110	20						154	+0.1	2		
	1120	30						155	+0.1	2		
	1130	40						155	+0.1	2		
	1130	-										
9-9-74	1300	-	59	125	0	0		86	-0.05	1	7500	
	1310	10						86	-0.05	1		
	1310	-						-	-	-	10000	
	1320	10						88	+0.05	1		
	1330	20						88	+0.05	1		
	1340	-						-	-	-	15000	
	1340	10						99	-0.1	2		
	1350	20						100	-0.1	2		
	1350	-						-	-	-	20000	
	1400	10						112	-0.2	4		
	1410	20						112	-0.2	4		
	1410	-						-	-	-	25000	
	1420	10						122	-0.1	2		
	1430	20						126	-0.1	2		
	1440	30						126	-0.1	2		
	1440	-						-	-	-	30000	
	1450	10						140	-0.2	4		
	1500	20						144	-0.2	4		
1510	30						144	-0.2	4			

TEST NO 5 BRG NO 42 RETAINER A9H INT. CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GROOVES 3 MM

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
29-8-74	0800	-	43	75	0	0	88	91	+0.3	7	7500	
	0810	10					84	90	+0.3	7		
	0815	15					84	90	+0.3	7	↓	
	0815	-									10000	
	0825	10					84	90	+0.4	8.5		
	0835	20					84	90	+0.4	8.5	↓	
	0835	-									15000	
	0845	10					93	95	+0.2	4		
	0855	20					95	98	+0.1	2		
	0905	30					97	104	0	0		
	0915	40					102	106	-0.05	1	↓	
	0915	-									20000	
	0925	10					120	113	-0.05	1		
	0935	20					125	116	-0.1	2		
	0945	30					130	120	-0.05	1	↓	
	0945	-									25000	
	1000	15					154	134	-0.05	1		
	1010	25					155	138	-0.1	2		
	1020	35					157	140	-0.1	2	↓	
	1020	-									30000	
	1030	10					190	168	-0.1	2		
29-8-74	1040	20					192	174	-0.1	2		
	1050	30	↓	↓	↓	↓	193	174	-0.1	2	↓	
	1300	-	51	100	0	0	91	93	+0.15	3	7500	
	1310	10					88	92	+0.2	4		
	1320	20					88	92	+0.2	4	↓	
	1320	-									10000	
	1330	10					88	92	+0.3	7		
	1340	20					88	92	+		↓	
	1340	-									15000	
	1350	10					98	97	+0.2	4		
	1400	20					102	100	+0.2	4		
	1410	30					102	102	+0.2	4	↓	
	1410	-									20000	
	1420	10					125	112	0	0		
	1430	20					129	116	+0.05	1		
	1440	30					129	117	+0.05	1	↓	
	1440	-									25000	
	1450	10					170	150	+0.05	1		
	1500	20					173	150	+0.1	2		
	1510	30					168	148	+0.1	2	↓	
	1510	-									30000	
3-9-74	1520	10					197	164	-0.05	1		
	1530	20					203	160	-0.05	1		
	1540	30	↓	↓	↓	↓	204	160	-0.05	1	↓	
	0805	-	59	125	0	0	83	88	+0.15	3	7500	
	0815	10					82	88	+0.2	4		
	0825	20					81	86	+0.15	3	↓	
	0825	-									10000	
	0830	5					81	86	+0.35	7.5		
	0840	15					80	86	+0.35	7.5	↓	
	0840	-									15000	
	0850	10					91	90	+0.2	4		
	0900	20					91	92	+0.2	4		
	0910	30					91	92	+0.2	4	↓	
	0910	-									20000	
	0920	10					105	99	+0.15	3		
	0930	20					106	101	+0.15	3		
	0940	30					106	102	+0.2	4		
	0950	40					106	102	+0.4	8.5	↓	
	0950	-									25000	
	0955	5										
	1000	10					122	110	+0.2	4		
	1010	20					124	114	+0.2	4		
	1020	30					126	116	+0.2	4		
	1030	40					127	116	+0.2	4	↓	
	1030	-									30000	
	1040	10					150	132	+0.05	1		
	1050	20					154	138	0	0		
	1100	30					157	140	-0.05	1	↓	

TEST NO 5 BRG. NO 42 RETAINER A₁ INT. CL 5 MILS BALL HOLE CL 10 MILS CAGE-LAND CL 15 MILS GREYES 3 MIL

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
3-9-74	1110	40	59	125	0	0	158	144	-0.05	1	30000	
	1120	50					159	144	-0.05	1		
3-9-74	1300	-	67	150	0	0	84	81	-0.2	4	7500	
	1310	10					80	88	-0.2	4		
	1320	20					78	87	-0.2	4		
	1320	-					-	-	-	-	10000	
	1330	10					81	87	-0.15	3		
	1340	20					81	87	-0.15	3		
	1340	-					-	-	-	-	15000	
	1350	10					89	87	-0.2	4		
	1400	20					89	87	-0.2	4		
	1400	-					-	-	-	-	20000	
	1410	10					105	102	-0.35	7.5		
	1420	20					107	104	-0.30	7		
	1430	30					108	105	-0.35	7.5		
	1440	40					108	105	-0.35	7.5		
	1440	-					-	-	-	-	25000	
	1450	10					128	112	-0.35	7.5		
	1500	20					130	118	-0.35	7.5		
	1510	30					130	120	-0.35	7.5		
	1510	-					-	-	-	-	30000	
	1520	10					155	136	-0.45	10		
	1530	20					155	136	-0.5	11		
	1540	30					156	136	-0.5	11		
4-9-74	0800	-	47	75	8	25	88	90	-0.3	7	7500	
	0810	10					85	90	-0.3	7		
	0820	20					83	88	-0.3	7		
	0820	-					-	-	-	-	10000	
	0830	10					86	90	-0.2	4		
	0840	20					85	88	-0.15	3		
	0840	-					-	-	-	-	15000	
	0850	10					93	92	-0.3	7		
	0900	20					99	92	-0.3	7		
	0910	-					-	-	-	-	20000	
	0910	10					103	100	-0.35	7.5		
	0920	20					105	102	-0.4	8.5		
	0930	30					106	104	-0.4	8.5		
	0940	40					105	105	-0.4	8.5		
	0940	-					-	-	-	-	25000	
	0950	10					124	112	-0.4	8.5		
	1000	20					125	116	-0.4	8.5		
	1010	30					124	116	-0.4	8.5		
	1010	-					-	-	-	-	30000	
	1020	10					146	134	-0.5	11		
	1030	20					148	139	-0.55	12		
	1040	30					150	141	-0.55	12		
	1050	40					150	141	-0.55	12		
4-9-74	1300	-	43	75	16	50	87	88	+0.05	1	7500	
	1310	10					88	88	+0.05	1		
	1310	-					-	-	-	-	10000	
	1320	10					90	94	+0.1	2		
	1330	20					89	94	+0.1	2		
	1330	-					-	-	-	-	15000	
	1340	10					102	101	-0.05	1		
	1350	20					102	102	-0.1	2		
	1400	30					102	102	-0.1	2		
	1400	-					-	-	-	-	20000	
	1410	10					112	111	-0.25	5		
	1420	20					118	113	-0.2	4		
	1430	30					118	113	-0.2	4		
	1430	-					-	-	-	-	25000	
	1440	10					125	115	-0.15	3		
	1450	20					126	116	-0.15	3		
	1500	30					126	116	-0.15	3		
	1500	-					-	-	-	-	30000	
	1510	10					153	140	-0.2	4		
	1520	20					156	146	-0.2	4		
	1530	30					156	146	-0.2	4		
5-9-74	0830	-	43	75	24	75	89	94	+0.15	3	7500	
	0840	10					88	94	+0.15	3		

TEST NO 5 BRG NO 42 RETAINER A₄H₉ INT CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GREYES 3₄IN.

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
5-9-74	0840	-	43	75	24	75	-	-	-	-	10000	
	0850	10					93	88	+0.2	4		
	0900	20					93	88	+0.2	4		
	0910	-					-	-	-	-	15000	
	0910	10					103	104	+0.1	2		
	0920	20					103	103	+0.1	2		
	0920	-					-	-	-	-	20000	
	0930	10					120	111	0	0		
	0940	20					123	118	0	0		
	0950	30					123	118	0	0		
	0950	-					-	-	-	-	25000	
	1000	10					128	120	-0.05	1		
	1010	20					128	120	-0.05	1		
	1020	30					128	120	-0.05	1		
	1020	-					-	-	-	-	30000	
	1030	10					152	142	-0.1	2		
	1040	20					153	146	-0.05	1		
	1050	30					152	146	-0.05	1		
5-9-74	1300	-	51	100	9	25	82	86	-0.2	4	7500	
	1310	10					82	86	-0.2	4		
	1310	-					-	-	-	-	10000	
	1320	10					82	87	-0.05	1		
	1330	20					84	88	-0.05	1		
	1340	30					85	88	-0.05	1		
	1340	-					-	-	-	-	15000	
	1345	5					98	96	-0.05	1		
	1350	10					98	98	-0.05	1		
	1350	-					-	-	-	-	20000	
	1400	10					108	104	+1.2	27.5		questionable yielding high fluctuation
	1410	20					110	105	+0.4	8.5		
	1420	30					110	105	+0.6	13.5		
	1420	-					-	-	-	-	25000	
	1430	10					126	114	-1.2	27.5		
	1440	20					127	116	-1.2	27.5		
	1450	30					127	116	-1.4	32.5		
	1450	-					-	-	-	-	30000	
	1500	10					160	142	-0.1	2		
	1510	20					164	148	-0.1	2		
	1520	30					164	148	-0.1	2		
6-9-74	0800	-	51	100	16	50	89	94	+0.2	4	7500	
	0810	10					8	94	+0.2	4		
	0810	-					-	-	-	-	10000	
	0820	10					92	96	+0.3	7		
	0830	20					92	96	-	-		
	0830	-					-	-	-	-	15000	
	0840	10					104	104	+0.2	4		
	0850	20					104	106	+0.2	4		
	0900	30					104	106	+0.2	4		
	0900	-					-	-	-	-	20000	
	0910	10					118	114	+0.1	2		
	0920	20					118	115	+0.1	2		
	0930	30					118	114	+0.1	2		
	0930	-					-	-	-	-	25000	
	0935	5					124	115	+0.2	4		
	0945	15					128	118	+0.2	4		
	0955	25					128	118	+0.2	4		
	0955	-					-	-	-	-	30000	
	1005	10					158	144	+0.15	3		
	1015	20					162	148	+0.15	3		
	1025	30					162	148	+0.15	3		
10-9-74	0810	-	51	100	24	75	93	98	+0.1	2	7500	
	0820	10					91	88	+0.1	2		
	0830	20					89	88	+0.1	2		
	0830	-					-	-	-	-	10000	
	0840	10					94	102	+0.15	3		
	0850	20					94	102	+0.15	3		
	0850	-					-	-	-	-	15000	
	0900	10					104	107	+0.05	1		
	0910	20					104	107	+0.05	1		
	0910	-					-	-	-	-	20000	

TEST NO 5 BRC NO 42 RETAINER A₉H₉ INT. CL 5 MILS BALL HOLE CL 1/8 MILS CAGE-LAND CL 1/5 MILS GROOVES 3 MIL

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP		BEARING TORQUE		SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM	
10-9-74	0920	10	51	100	24	75	112	114	-0.05	1	20000	
	0930	20					113	116	-0.05	1		
	0940	30					113	116	-0.05	1		
	0940	-									25000	
	0950	10					127	121	0	0		
	1000	20					127	121	0	0		
	1010	30					127	123	0	0		
	1020	-									30000	
	1020	10					146	136	-0.05	1		
	1030	20					149	142	-0.05	1		
	1040	30					149	142	-0.05	1		
9-9-74	0745	-	67	150	8	25	94	96	+0.3	7	7500	
	0755	10					95	97	+0.35	7.5		
	0805	20					88	80	+0.3	7		
	0805	-									10000	
	0815	10					92	100	+0.4	8.5		
	0825	20					91	88	+0.4	8.5		
	0825	-									15000	
	0835	10					97	103	+0.3	7		
	0845	20					96	102	+0.3	7		
	0845	-									20000	
	0855	10					111	110	+0.3	7		
	0905	20					111	111	+0.3	7		
	0905	-									25000	
	0915	10					130	120	+0.3	7		
	0925	20					131	124	+0.3	7		
	0935	30					133	125	+0.3	7		
	0945	40					132	126	+0.3	7		
	0955	50					133	126	+0.3	7		
9-9-74	0955	-									30000	
	1005	10					158	142	+0.2	4		
	1015	20					162	148	+0.2	4		
	1025	30					164	150	+0.2	4		
	1035	40					164	150	+0.2	4		
	1300	-	67	150	16	50	91	97	+0.1	2	7500	
	1310	10					88	97	+0.1	2		
	1310	-									10000	
	1320	10					90	99	+0.25	5		
	1330	20					90	98	+0.25	5		
	1330	-									15000	
	1340	10					97	101	+0.1	2		
	1350	20					97	101	+0.1	2		
	1350	-									20000	
	1400	10					113	110	+0.05	1		
	1410	20					114	112	0	0		
	1420	30					114	113	0	0		
	1420	-									25000	
10-9-74	1430	10					131	122	+0.1	2		
	1440	20					134	126	+0.1	2		
	1450	30					134	126	+0.1	2		
	1450	-									30000	
	1500	10					160	146	0	0		
	1510	20					162	148	0	0		
	1520	30					162	148	0	0		
	1250	-	67	150	24	75	90	98	+0.25	5	7500	
	1300	10					87	96	+0.3	7		
	1310	20					84	94	+0.3	7		
	1310	-									10000	
	1320	10					88	94	+0.4	8.5		
	1330	20					88	96	+0.4	8.5		
	1330	-									15000	
	1340	10					98	101	+0.25	5		
	1350	20					98	102	+0.25	5		
	1350	-									20000	
	1400	10					114	110	+0.2	4		
	1410	20					121	117	+0.15	3		
	1420	30					121	117	+0.15	3		
	1420	-									25000	
	1430	10					133	125	+0.25	5		
	1440	20					135	126	+0.25	5		

TEST NO. 5		BRG. NO. 42		RETRAINER A ₉ H ₉		INT. CL. 5 MILS		BALL HOLE CL 10 MILS		CAGE LAND CL 15 MILS		GREYES 3 MIL	
DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS	
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ			
10-9-74	1450	30	67	150	24	75	136	127	+0.2	4	25000		
	1450	-					-	-	-	-	30000		
	1500	10					162	146	+0.2	4			
	1510	20					163	148	+0.2	4			
	1520	30					165	151	+0.2	4			
	1530	40					166	151	+0.2	4			

TEST NO 6 BRG NO 23 RETAINER WGT INT CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES NO

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
16-9-74	1250	-	43	75	0	0	93	96	-0.05	1	7500	
	1300	10					93	95	-0.05	1		
	1300	-					-	-	-	-	10000	
	1310	10					128	118	-0.05	1		
	1320	20					103	116	0	0		
	1330	30					103	112				
	1330	-					-	-	-	-	15000	
	1335	5					119	116	-0.05	1		
	1345	15					118	115	-0.05	1		
	1345	-					-	-	-	-	20000	
	1355	10					128	116	-0.05	1		
	1405	20					128	117	-0.05	1		
	1415	30					128	117	-0.05	1		
	1415	-					-	-	-	-	25000	
	1425	10					148	130	-0.15	3		
	1435	20					150	134	-0.15	3		
	1445	30					153	136	-0.15	3		
	1450	35					153	136	-0.15	3		
	1450	-					-	-	-	-	30000	
	1500	10					258	192	-0.3	7		
	1510	20					232	193	-0.3	7		
	1520	30					266	212	-0.4	8.5		
↓	1530	40	↓	↓	↓	↓	265	212	-0.3	7	↓	
17-9-74	0900	-	51	100	0	0	99	98	-0.3	7	7500	
	0910	10					100	100	-0.3	7		
	0920	20					100	100	-0.3	7		
	0920	-					-	-	-	-	10000	
	0931	10					114	108	-0.25	5		
	0940	20					119	113	-0.25	5		
	0950	30					119	114	-0.25	5		
	0950	-					-	-	-	-	15000	
	1000	10					133	124	-0.2	4		
	1010	20					132	130	-0.1	2		
	1020	30					133	129				
	1020	-					-	-	-	-	20000	
	1030	10					146	132	-0.2	4		
	1040	20					148	132	-0.2	4		
	1050	30					148	130	-0.2	4		
	1100	40					160	132	-0.2	4		
	1110	50					160	131	+0.1	2		
	1110	-					-	-	-	-	25000	
	1120	10					176	148	-0.25	5		
	1130	20					178	146	-0.25	5		
	1140	30					188	156	-0.3	7		
	1140	-					-	-	-	-	30000	
	1150	10					232	190	-0.3	7		
	1200	20					257	216	-0.3	7		
↓	1210	30	↓	↓	↓	↓	256	216	-0.3	7	↓	
17-9-74	1255	-	59	125	0	0	94	97	-0.05	1	7500	
	1305	10					94	97	-0.05	1		
	1305	-					-	-	-	-	10000	
	1315	10					100	100	+0.05	1		
	1325	20					95	98	+0.05	1		
	1335	30					94	98	+0.05	1		
	1335	-					-	-	-	-	15000	
	1345	10					219	186	-0.2	4		
	1355	20					219	186	-0.2	4		
↓	1405	30	↓	↓	↓	↓	192	172	-0.2			

TEST NO 7 BRG NO 32 RETAINER WGT INT CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES NO													
DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP		BEARING TORQUE		SPEED RPM	REMARKS	
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ			
7-10-74	1250	-	43	75	0	0		85	-0.1	2	7500		
	1300	10						88	-0.1	2			
	1310	20						86	-0.1	2			
	1310	-						-	-	-	10000		
	1320	10						92	-0.05	1			
	1330	20						92	-0.05	1			
	1330	-						-	-	-	15000		
	1340	10						102	-0.3	7			
	1350	20						105	-0.3	7			
	1400	30						105	-0.3	7			
	1410	40						105	-0.3	7			
	1410	-						-	-	-	20000		
	1420	20						112	+0.1	2			
	1440	30						112	+0.1	2			
	1440	-						-	-	-	25000		
	1450	10						118	-0.4	85			
	1500	20						122	-0.4	85			
	1510	30						122	-0.4	85			
	1510	-						-	-	-	30000		
	1520	10						-	-	-			
Failure - wear on ball pocket sides													
TEST NO 8 BRG NO 32 RETAINER WGT INT CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES NO													
8-10-74	1250	-	43	75	0	0		102	-0.05	1	7500		
	1300	10						102	-0.05	1			
	1300	-						-	-	-	10000		
	1310	10						112	+0.1	2			
	1320	20						112	+0.1	2			
	1320	-						-	-	-	15000		
	1330	10						138	-0.2	4			
	1340	20						148	-0.2	4			
	1350	30						148	-0.2	4			
	1350	-						-	-	-	20000		
	1400	10						178	-0.2	4			
	1400	-						178	-0.2	4			
	1410	10						196	-0.2	4			
	1420	20						200	-0.2	4			
	1430	30						200	-0.2	4			
	1430	-						-	-	-	30000		
	1440	10						-	-	-			
Failure -													
TEST NO 9 BRG NO 27 RETAINER WGT INT CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES NO													
9-10-74	0750	-	43	75	0	0		82	0.05	1	7500		
	0800	10						82	0.05	1			
	0800	-						-	-	-	10000		
	0810	10						84	0.1	2			
	0820	20						86	0.1	2			
	0830	-						86	-	-			
	0830	-						-	-	-	15000		
	0840	10						92	0.15	3			
	0850	20						98	0.2	4			
	0900	30						98	0.2	4			
	0900	-						-	-	-	20000		
	0910	10						98	0.15	3			
	0920	20						98	0.2	4			
	0930	30						99	0.2	4			
	0930	-						-	-	-	25000		
	0940	10						104	0.2	4			
	0950	20						103	0.2	4			
	0950	-						-	-	-	30000		
	1000	10						109	0.2	4			
	1010	20						123	0.45	1			
	1020	30						122	0.05	1			
Torque erratic													
Failure - Ball-Shroud Contact													

TEST NO. 10 BRC. NO. 1 RETAINER WGT INT. CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES 1 IN.

TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED		REMARKS
DATE	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM	
	0820	-	43	75	0	0		82	0.05	1	7500	
	0830	10						84	0.1	2		
	0840	20						84	0.1	2		
	0840	-						-	-	-	10000	
	0850	10						92	0.15	3		
	0900	20						92	0.15	3		
	0900	-						-	-	-	15000	
	0910	10						95	0.15	3		
	0920	20						95	0.15	3		
	0920	-						-	-	-	20000	
	0930	10						98	0.2	4		
	0940	20						106	0.2	4		
	0950	30						106	0.2	4		
	0950	-						-	-	-	25000	
	1000	10						108	0.2	4		
	1010	20						115	0.2	4		
	1020	30						115	0.2	4		
	1020	-						-	-	-	30000	
	1030	10						148	0.4	8.5		
	1040	20						150	0.4	8.5		Evidence of cage unbalance
	1050	30						150	0.4	8.5		

TEST NO. 11 BRG. NO 24 RETAINER AgHg INT. CL 10 MILS BALL HOLE CL 17 MILS GAGE LAND CL 22 MILS GREETES NO

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
11-12-74	0845	-	43	75	0	0			81	0.1	2	7500
	0855	10							81	0.1	2	
	0855	-							-	-	-	10000
	0905	10							83	0.15	3	
	0915	20							83	0.15	3	
	0915	-							-	-	-	15000
	0925	10							87	0.2	4	
	0935	20							93	0.2	4	
	0945	30							93	0.2	4	
	0945	-							-	-	-	20000
	0955	10							104	0.3	7	
	1005	20							106	0.3	7	
	1015	30							106	0.3	7	
	1015	-							-	-	-	25000
	1025	10							112	0.35	7.5	
	1035	20							118	0.35	7.5	
	1045	30							118	0.35	7.5	
	1045	-							-	-	-	30000
	1055	10							132	0.55	12	
	1105	20							144	0.6	13.5	
	1115	30							144	0.55	12	
11-12-74	1300	-	51	100	0	0			86	0.1	2	7500
	1310	10							86	0.1	2	
	1310	-							-	-	-	10000
	1320	10							88	0.1	2	
	1330	20							88	0.1	2	
	1330	-							-	-	-	15000
	1340	10							94	0.2	4	
	1350	20							98	0.2	4	
	1400	30							98	0.2	4	
	1400	-							-	-	-	20000
	1410	10							108	0.25	5	
	1420	20							114	0.25	5	
	1430	30							117	0.25	5	
	1440	40							117	0.25	5	
	1440	-							-	-	-	25000
	1450	10							132	0.4	8.5	
	1500	20							136	0.4	8.5	
	1510	30							136	0.4	8.5	
	1510	-							-	-	-	30000
	1520	10							154	0.5	11	
	1530	20							157	0.5	11	
	1540	30							157	0.5	11	
12-12-74	0750	-	59	125	0	0			85	0.15	3	7500
	0800	10							87	0.15	3	
	0810	20							87	0.15	3	
	0810	-							-	-	-	10000
	0820	10							90	0.2	4	
	0830	20							90	0.2	4	
	0830	-							-	-	-	15000
	0840	10							99	0.3	7	
	0850	20							103	0.3	7	
	0900	30							103	-	-	
	0900	-							-	-	-	20000
	0910	10							116	0.35	7.5	
	0920	20							120	0.3	7	
	0930	30							122	0.3	7	
	0940	40							122	0.3	7	
	0940	-							-	-	-	25000
	0950	10							134	0.4	8.5	
	1000	20							134	0.4	8.5	
	1000	-							-	-	-	30000
	1010	10							146	0.45	10	
	1020	20							156	0.45	10	
	1030	30							156	0.45	10	
13-12-74	1245	-	67	150	0	0			88	0.15	3	7500
	1255	10							88	0.15	3	
	1255	-							-	-	-	10000
	1305	10							90	0.2	4	
	1315	20							90	0.2	4	

TEST NO. 11 BRG. NO 24 RETAINER A₁ INT. CL 10 MILS BALL HOLE CL 17 MILS CAGE-LAND CL 22 MILS GROOVES NO

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
13-12-74	1315	—	67	150	0	0		—	—	—	15000	
	1325	10						96	0.25	5		
	1335	20						104	0.3	7		
	1345	30						108	0.3	7		
	1355	—						—	—	—	20000	
	1355	10						122	0.3	7		
	1405	20						122	0.3	7		
	1405	—						—	—	—	25000	
	1415	10						132	0.35	7.5		
	1425	20						135	0.4	8.5		
	1435	30						138	0.35	7.5		
	1440	35						138	0.35	7.5		
	1440	—						—	—	—	30000	
	1445	5						144	0.4	8.5		
	1455	15						150	0.4	8.5		
	1505	25						152	0.4	8.5		
	1515	35						152	0.4	8.5		
16-12-74	0810	—	43	75	8	25		84	0.05	1	7500	
	0820	10						84	0	0		
	0820	—						—	—	—	10000	
	0830	10						84	0.05	1		
	0840	20						85	0.05	1		
	0850	30						85	0.05	1		
	0850	—						—	—	—	15000	
	0900	10						97	0.1	2		
	0910	20						100	0.1	2		
	0920	30						100	0.1	2		
	0920	—						—	—	—	20000	
	0930	10						108	0.15	3		
	0940	20						111	0.15	3		
	0950	30						111	0.15	3		
	0950	—						—	—	—	25000	
	1000	10						126	0.2	4		
	1010	20						130	0.2	4		
	1020	30						130	0.2	4		
	1020	—						—	—	—	30000	
	1030	10						148	0.4	8.5		
16-11-74	1040	20						158	0.4	8.5		
	1050	30						158	0.4	8.5		
	1245	—	43	75	16	50		87	0.01	1	7500	
	1255	10						87	0.05	1		
	1255	—						—	—	—	10000	
	1305	10						88	0.2	4		
	1315	20						88	0.2	4		
	1315	—						—	—	—	15000	
	1325	10						92	0.25	5		
	1335	20						102	0.25	5		
	1345	30						102	0.25	5		
	1345	—						—	—	—	20000	
	1355	10						116	0.3	7		
	1405	20						120	0.3	7		
	1415	30						122	0.25	5		
	1425	40						122	0.25	5		
	1425	—						—	—	—	25000	
	1435	10						132	0.35	7.5		
	1445	20						140	0.35	7.5		
	1455	30						140	0.35	7.5		
	1455	—						—	—	—	30000	
17-11-74	1505	10						152	0.5	11		
	1515	20						164	0.5	11		
	1525	30						165	0.5	11		
	0240	—	43	75	24	75		88	0.05	1	7500	
	0250	10						88	0.05	1		
	0250	—						—	—	—	10000	
	0300	10						89	0.1	2		
	0310	20						90	0.1	2		
	0320	10						100	0.15	3		
	0330	20						104	0.15	3		
	0340	30						104	0.15	3		

TEST NO. 11 BRG. NO 24 RETAINER A₁ INT. CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES No

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	APM	
17-11-74	0840	-	43	75	24	75		-	-	-	20000	
	0850	10						118	0.2	4		
	0900	20						124	0.2	4		
	0910	30						127	0.2	4		
	0920	40						127	0.2	4		
	0920	-						-	-	-	25000	
	0930	10						138	0.25	5		
	0940	20						144	0.25	5		
	0950	30						148	-	-		
	0950	-						-	-	-	30000	
	1000	10						172	0.3	7		
	1010	20						177	0.3	7		
	1020	30						177	0.3	7		
	1020	-						-	-	-		
	1245	-	51	100	8	25		88	0.1	2	7500	
	1255	10						88	0.1	2		
17-11-74	1255	-						-	-	-	10000	
	1305	10						90	0.1	2		
	1315	20						90	0.1	2		
	1315	-						-	-	-	15000	
	1325	10						103	0.2	4		
	1335	20						103	0.2	4		
	1335	-						-	-	-	20000	
	1345	10						116	0.3	7		
	1355	20						120	0.3	7		
	1405	30						124	0.3	7		
	1415	40						124	0.3	7		
	1415	-						-	-	-	25000	
	1425	10						134	0.35	7.5		
	1435	20						150	0.4	8.5		
	1445	30						160	0.4	8.5		
	1455	40						160	0.4	8.5		
	1455	-						-	-	-	30000	
	1505	10						163	0.45	10		
	1515	20						164	0.45	10		
	1525	30						164	0.45	10		
18-11-74	0750	-	51	100	16	50		88	0.1	2	7500	
	0800	10						88	0.1	2		
	0800	-						-	-	-	10000	
	0810	10						92	0.15	3		
	0820	20						92	0.15	3		
	0820	-						-	-	-	15000	
	0830	10						100	0.25	5		
	0840	20						108	0.45	5		
	0850	30						108	0.25	5		
	0850	-						-	-	-	20000	
	0900	10						129	0.35	7.5		
	0910	20						135	0.35	7.5		
	0920	30						136	0.35	7.5		
	0920	-						-	-	-	25000	
	0930	10						139	0.35	7.5		
	0940	20						141	0.35	7.5		
	0950	30						141	0.35	7.5		
	0950	-						-	-	-	30000	
	1000	10						154	0.5	11		
	1010	20						162	0.5	11		
	1020	30						162	0.5	11		
18-11-74	1250	-	51	100	24	75		84	0.2	4	7500	
	1300	10						84	0.2	4		
	1300	-						-	-	-	10000	
	1310	10						88	0.25	5		
	1320	20						88	0.25	5		
	1320	-						-	-	-	15000	
	1330	10						104	0.3	7		
	1340	20						104	0.3	7		
	1340	-						-	-	-	20000	
	1350	10						116	0.35	7.5		
	1400	20						121	0.35	7.5		
	1410	30						126	0.35	7.5		
	1420	40						126	0.35	7.5		
	1420	-						-	-	-	25000	
	1430	-						-	-	-		
	1440	-						-	-	-		
	1450	-						-	-	-		

TEST NO 11 BRG. NO 24 RETAINER A₁₀ INT. CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES NO

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN. OZ		
8-12-74	1430	10	51	100	24	75			136	0.4	8.5	25000
	1440	20							146	0.4	8.5	
	1450	30							146	0.4	8.5	
	1450	-							-	-	-	30000
	1500	10							169	0.5	11	
	1510	20							180	0.5	11	
	1520	30							180	0.5	11	
11-11-74	0745	-	67	150	8	25			88	0.1	2	7500
	0755	10							88	0.1	2	
	0755	-							-	-	-	10000
	0805	10							94	0.1	2	
	0815	20							98	0.1	2	
	0815	-							-	-	-	15000
	0825	10							106	0.15	3	
	0835	20							110	0.15	3	
	0845	30							110	0.15	3	
	0845	-							-	-	-	20000
	0855	10							138	0.2	4	
	0905	20							145	0.2	4	
	0915	30							148	0.2	4	
	0925	40							148	0.2	4	
	0925	-							-	-	-	25000
	0935	10							159	0.25	5	
	0945	20							163	0.25	5	
	0955	30							163	0.25	5	
	0955	-							-	-	-	30000
	1005	10							184	0.25	5	
	1015	20							186	0.25	5	
	1025	30							184	0.25	5	
12-1-75	0745	-	67	150	16	50			92	0.1	2	7500
	0755	10							92	0.1	2	
	0755	-							-	-	-	10000
	0805	10							98	0.15	3	
	0815	20							98	0.15	3	
	0815	-							-	-	-	15000
	0825	10							108	0.25	5	
	0835	20							116	0.25	5	
	0845	30							116	0.25	5	
	0845	-							-	-	-	20000
	0855	10							134	0.3	7	
	0905	20							144	0.3	7	
	0915	30							150	0.3	7	
	0925	40							153	0.35	7.5	
	0935	50							155	0.4	8.5	
	0945	60							157	0.4	8.5	
	0950	65							158	0.4	8.5	
	1000	75							162	0.4	8.5	
	1010	85							162	0.4	8.5	
	1010	-							-	-	-	25000
	1020	10							178	0.45	10	
	1030	20							179	0.45	10	
	1030	-							-	-	-	30000
	1040	10							184	0.45	10	
	1050	20							184	0.45	10	
12-1-75	1255	-	67	150	24	75			92	0.05	1	7500
	1305	10							92	0.05	1	
	1305	-							-	-	-	10000
	1315	10							96	0.1	2	
	1325	20							96	0.1	2	
	1325	-							-	-	-	15000
	1335	10							107	0.15	3	
	1345	20							114	0.2	4	
	1355	30							114	0.2	4	
	1355	-							-	-	-	20000
	1405	10							144	0.25	5	
	1415	20							158	0.3	7	
	1425	30							162	0.3	7	
	1435	40							162	0.3	7	
	1435	-							-	-	-	25000
	1445	10							186	0.35	7.5	

TEST NO 12 BRG NO 2 RETAINER A ₉ H ₄ INT CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES 1 MIL													
TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED		REMARKS	
DATE	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM		
3-1-75	1250	-	43	75	0	0		84	0.2	4	7500		
	1300	10						84	0.2	4	↓		
	1300	-						-	-	-	10000		
	1310	10						89	0.25	5	↓		
	1320	20						89	0.25	5	↓		
	1320	-						-	-	-	15000		
	1330	10						104	0.25	5	↓		
	1340	20						104	-	-	↓		
	1340	-						-	-	-	20000		
	1350	10						118	0.4	8.5	↓		
	1400	20						128	0.4	8.5	↓		
	1410	30						136	0.4	8.5	↓		
	1420	40						147	0.4	8.5	↓		
	1430	50						147	0.4	8.5	↓		
	1430	-						-	-	-	25000		
	1440	10						198	0.45	10	↓		
	1450	20											
Excessive temperatures imbalance caused cage O.D. To contact bearing O.R. Cage ID under note													
TEST NO 13 BRG NO 6 RETAINER A ₉ H ₄ INT CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES 1 MIL													
2-1-75	1250	-	43	75	0	0		86	0.05	1	7500		
	1300	10						86	0.05	1	↓		
	1300	-						-	-	-	10000		
	1310	10						88	0.1	2	↓		
	1320	20						88	0.1	2	↓		
	1320	-						-	-	-	15000		
	1330	10						98	0.15	3	↓		
	1340	20						102	0.15	3	↓		
	1350	30						103	0.15	3	↓		
	1350	-						-	-	-	20000		
	1400	10						124	0.2	4	↓		
	1410	20						124	0.2	4	↓		
	1410	-						-	-	-	25000		
	1420	10											
TEST NO 14 BRG NO 6 RETAINER A ₉ H ₄ INT CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 36 MILS GROOVES 1 MIL													
14-1-75	0755	-	43	75	0	0		81	0.05	1	7500		
	0805	10						81	0.05	1	↓		
	0805	-						-	-	-	10000		
	0815	10						83	0.1	2	↓		
	0825	20						83	0.1	2	↓		
	0825	-						-	-	-	15000		
	0835	10						91	0.15	3	↓		
	0845	20						91	0.15	3	↓		
	0845	-						-	-	-	20000		
	0855	10						98	0.2	4	↓		
	0905	20						102	0.2	4	↓		
	0915	30						103	0.2	4	↓		
	0915	-						-	-	-	25000		
	0925	10						114	0.3	7	↓		
	0935	20						122	0.35	7.5	↓		
	0945	30						128	0.35	7.5	↓		
	0955	40						128	0.35	7.5	↓		
	0955	-						-	-	-	30000		
	1005	10						146	0.45	10	↓		
	1015	20						152	0.45	10	↓		
	1025	30						152	0.45	10	↓		
15-1-75	0750	-	51	100	0	0		84	0.05	1	7500		
	0800	10						84	0.05	1	↓		
	0800	-						86	0.1	2	10000		
	0810	10						86	0.1	2	↓		
	0810	-						-	-	-	15000		
	0820	10						93	0.2	4	↓		
	0830	20						97	0.2	4	↓		
	0840	30						97	0.2	4	↓		
	0850	-						-	-	-	20000		
	0850	10						108	0.3	7	↓		
	0900	20						113	0.3	7	↓		
	0910	30						113	0.3	7	↓		

TEST NO 14 BRG. NO 6 RETAINER A₉ 17₄ INT. CL 10 MILS BALL HOLE CL 17 MILS CAGE LAND CL 36 MILS GROOVES 1 MIL

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
15-1-75	0910	—	51	100	0	0		—	—	—	25000	
	0920	10						123	0.4	8.5		
	0930	20						129	0.45	10		
	0940	30						132	0.45	10		
	0950	40						132	0.45	10		
	0950	—						—	—	—	30000	
	1000	10						154	0.55	12		
	1010	20						155	0.55	12		
	1020	30						155	0.55	12		
	1020	—						—	—	—		
15-1-75	1245	—	59	125	0	0		—	0.2	4	7500	
	1255	10						89	0.2	4		
	1305	20						89	0.2	4		
	1325	—						—	—	—	10000	
	1315	10						91	0.25	5		
	1325	20						91	0.25	5		
	1325	—						—	—	—	15000	
	1335	10						98	0.35	7.5		
	1345	20						103	0.35	7.5		
	1355	30						103	0.35	7.5		
	1355	—						—	—	—	20000	
	1405	10						106	0.4	8.5		
	1415	20						116	0.4	8.5		
	1425	30						116	0.4	8.5		
	1425	—						—	—	—	25000	
	1435	10						128	0.5	11		
	1445	20						138	0.55	12		
	1455	30						138	0.55	12		
	1455	—						—	—	—	30000	
	1505	10						144	0.6	13.5		
	1515	20						144	0.6	13.5		
	1525	30						144	0.6	13.5		
16-1-75	0745	—	67	150	0	0		86	0.2	4	7500	
	0755	10						86	0.2	4		
	0755	—						—	—	—	10000	
	0805	10						89	0.25	5		
	0815	20						89	0.25	5		
	0815	—						—	—	—	15000	
	0825	10						94	0.4	8.5		
	0835	20						100	0.4	8.5		
	0845	30						100	0.4	8.5		
	0845	—						—	—	—	20000	
	0855	10						117	0.5	11		
	0905	20						120	0.55	12		
	0915	30						120	0.55	12		
	0915	—						—	—	—	25000	
	0925	10						122	0.6	13.5		
	0935	20						122	0.6	13.5		
	0935	—						—	—	—	30000	
	0945	10						124	0.6	13.5		
	0955	20						130	0.6	13.5		
	1005	30						130	0.6	13.5		
16-1-75	1330	—	43	75	8	25		82	0.05	1	7500	
	1340	10						82	0.05	1		
	1340	—						—	—	—	10000	
	1350	10						84	0.1	2		
	1400	20						84	0.1	2		
	1400	—						—	—	—	15000	
	1410	10						90	0.15	3		
	1420	20						94	0.15	3		
	1430	30						94	0.15	3		
	1430	—						—	—	—	20000	
	1440	10						98	0.2	4		
	1450	20						98	0.2	4		
	1450	—						—	—	—	25000	
	1500	10						104	0.2	4		
	1510	20						106	0.2	4		
	1520	30						106	0.2	4		
	1520	—						—	—	—	30000	
	1530	10						116	0.3	7		
	1540	20						116	0.3	7		

TEST NO 14 BRG. NO 6 RETAINER A₆ H₆ INT. CL 10 MILS BALL HOLE CL 17 MILS CAGE-LAND CL 36 MILS GRINDS / MIL

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP		BEARING TORQUE		SPEED RPM	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ		
16-1-75	1550	30	43	75	8	25		82	0.3	7	3000	
17-1-75	0745	-	43	75	16	50		81	0.25	1	7500	
	0755	10						81	0.05	1	↓	
	0755	-						-	-	-	10000	
	0805	10						84	0.05	1	↓	
	0815	20						84	0.05	1	↓	
	0815	-						-	-	-	15000	
	0825	10						88	0.1	2	↓	
	0835	20						90	0.1	2	↓	
	0845	30						90	0.1	2	↓	
	0845	-						-	-	-	20000	
	0855	10						96	0.15	3	↓	
	0905	20						98	0.15	3	↓	
	0915	30						98	0.15	3	↓	
	0915	-						-	-	-	25000	
	0925	10						102	0.15	3	↓	
	0935	20						106	0.15	3	↓	
	0945	30						106	0.15	3	↓	
	0945	-						-	-	-	30000	
	0955	10						120	0.25	5	↓	
	1005	20						122	0.25	5	↓	
	1015	30	↓	↓	↓	↓		122	0.25	5	↓	
17-1-75	1245	-	43	75	24	75		84	0.05	1	7500	
	1255	10						84	0.05	1	↓	
	1255	-						-	-	-	10000	
	1305	10						86	0.1	2	↓	
	1315	20						86	0.1	2	↓	
	1315	-						-	-	-	15000	
	1325	10						88	0.1	2	↓	
	1335	20						88	0.1	2	↓	
	1335	-						-	-	-	20000	
	1345	10						96	0.15	3	↓	
	1355	20						96	0.15	3	↓	
	1355	-						-	-	-	25000	
	1405	10						98	0.15	3	↓	
	1415	20						101	0.15	3	↓	
	1425	30						101	0.15	3	↓	
	1425	-						-	-	-	30000	
	1435	10						104	0.3	7	↓	
	1445	20						116	0.4	8.5	↓	
	1455	30	↓	↓	↓	↓		116	0.4	8.5	↓	
20-1-75	0750	-	51	100	8	25		82	0.1	2	7500	
	0800	10						82	0.1	2	↓	
	0810	-						-	-	-	10000	
	0810	10						85	0.15	3	↓	
	0820	20						85	0.15	3	↓	
	0820	-						-	-	-	15000	
	0830	10						90	0.2	4	↓	
	0840	20						96	0.4	4	↓	
	0850	30						96	0.4	4	↓	
	0850	-						-	-	-	20000	
	0900	10						96	0.4	8.5	↓	
	0910	20						100	0.4	8.5	↓	
	0920	30						100	0.4	8.5	↓	
	0920	-						-	-	-	25000	
	0930	10						102	0.4	8.5	↓	
	0940	20						111	0.4	8.5	↓	
	0950	30						111	0.6	13.5	↓	
	0950	-						-	-	-	30000	
	1000	10										

TEST NO 15 BRG NO 92 RETAINER WGT INT CL 5 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES 3 MM

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP		BEARING TORQUE		SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM	
8-1-75	0830	-	43	75	0	0		93	0.15	3	7500	
	0840	10						93	0.15	3		
	0850	-									10000	
	0900	10						100	0.2	4		
	0910	20						100	0.2	4		
	0920	-									15000	
	0930	10						112	0.2	4		
	0940	20						112	0.2	4		
	0950	-									20000	
	1000	10						128	0.25	5		
	1010	20						130	0.25	5		
	1020	30						130	0.25	5		
	1030	-									25000	
	1040	10						144	0.3	7		
	1050	20						146	0.3	7		
	1100	30						146	0.3	7		
	1110	-									30000	
	1120	10						210	0.5	7		
	1130	20						227	0.5	7		
	1140	30						227	0.5	7		
9-1-75	0750	-	51	100	0	0		96	0.05	1	7500	
	0800	10						96	0.05	1		
	0810	-									10000	
	0820	10						112	0.1	2		
	0830	20						112	0.1	2		
	0840	-									15000	
	0850	10						132	0.15	3		
	0900	20						132	0.15	3		
	0910	-									20000	
	0920	10						166	0.2	4		
	0930	20						174	0.2	4		
	0940	30						176	0.2	4		
	0950	40						176	0.2	4		
	1000	-									25000	
	1010	10						210	0.2	4		
	1020	20						218	0.2	4		
	1030	30						218	0.2	4		
	1040	-									30000	
	1050	10						288	0.2	4		
	1100	20						288	0.2	4		
9-1-75	1245	-	59	125	0	0		130	0.2	4	7500	
	1255	10						130	0.2	4		
	1305	-									10000	
	1310	10						144	0.3	7		
	1315	15						144	0.3	7		
	1320	-									15000	
	1330	10						190	0.3	7		
	1335	20						190	0.3	7		
	1340	-									20000	
	1345	10						200	0.3	7		
	1350	20						205	0.3	7		
	1400	30						205	0.3	7		
	1410	-									25000	
	1420	10						265	0.35	7.5		
	1430	20						274	0.35	7.5		
	1440	30						279	0.3	7		
	1450	40						290	0.35	7.5		
	1500	50						292	0.35	7.5		
	1510	-						322			30000	

Run stopped due to high temperatures. Cage O.D. - outer race contact had occurred.

TEST NO 16 BRG NO 93 RETAINER WGT INT CL 5 MILS BALL HOLE CL 17 MILS CAGE LAND CL 22 MILS GROOVES 3 MM

Upon initiation of this test series high torque readings of 0.4 were encountered. Inspection showed shaft had rubbed against a carbon sleeve in the rig. Upon test resumption torque readings of 0.35 were encountered at 7500 RPM. Upon reinspection it was found that the bearing races and ball tracks were quite rough indicating the bearing was defective to start with. The retainer looked good. This test failed.

TEST NO 17 BRG. NO 22 RETAINER A₉₁₄ INT. CL 10 MILS DALL NOLE CL 10 MILS GAGE LAND CL 15 MILS GREYES 1 MIL

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP		BEARING TORQUE		SPEED	REMARKS
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM	
20-3-75	1250	-	43	75	0	0		88	0.1	2	7500	
	1300	10						88	0.1	2	↓	
	1300	-						-	-	-	10000	
	1310	10						92	0.1	2	↓	
	1320	20						92	0.1	2	↓	
	1320	-						-	-	-	15000	
	1330	10						100	0.15	3	↓	
	1340	20						100	0.15	3	↓	
	1340	-						-	-	-	20000	
	1350	10						112	0.2	4	↓	
	1400	20						112	0.2	4	↓	
	1400	-						-	-	-	25000	
	1410	10						140	0.25	5	↓	
	1420	20						146	0.25	5	↓	
	1430	30						154	0.3	7	↓	
	1440	40						154	0.3	7	↓	
	1440	-						-	-	-	30000	
	1450	10										
			Torque reading rose to 0.4 and temperature jumped to 200°F. Inspection showed test bearing retainer nut had not been installed. Retainer had rubbed on motor race but no metal to metal contact.									
21-3-75	0840	-						90	0.05	1	7500	
	0850	10						90	0.05	1	↓	
	0850	-						-	-	-	10000	
	0900	10						92	0.05	1	↓	
	0910	20						92	0.05	1	↓	
	0910	-						-	-	-	15000	
	0920	10						102	0.15	3	↓	
	0930	20						106	0.15	3	↓	
	0940	30						106	0.15	3	↓	
	0940	-						-	-	-	20000	
	0950	10						121	0.2	4	↓	
	1000	20						121	0.2	4	↓	
	1000	-						-	-	-	25000	
	1010	10						180	0.4	8.5	↓	
	1020	20						204	0.45	10	↓	
	1023	23						207	0.5	11	↓	unstable operation
			Inspection showed heavy rub on Retainer ID, probably as the result of unbalance.									

TEST NO 18		BRG NO 50		RETAINER WGT		INT. CL 5 MILS		BALL HOLE CL 10 MILS		CAGE LAND CL 15 MILS		GRINDS 10	
DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED	REMARKS	
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM		
7-4-75	1255	-	43	75	0	0		93	0.15	3	7500		
	1305	10						93	0.15	3	↓		
	1305	-						-			10000		
	1315	10						102	0.25	5			
	1325	20						102	0.25	5	↓		
	1325	-						-			15000		
	1335	10						114	0.35	7.5			
	1345	20						116	0.35	7.5	↓		
	1355	30						116	0.35	7.5	↓		
	1355	-						-			20000		
	1405	10						121	0.35	7.5			
	1415	20						138	0.35	7.5	↓		
	1425	30						138	0.35	7.5	↓		
	1425	-						-			25000		
	1435	10						141	0.35	7.5			
	1445	20						142	0.35	7.5	↓		
	1455	30						142	0.35	7.5	↓		
	1455	-						-			30000		
	1505	10						152	0.4	8.5			
	1515	20						155	0.4	8.5	↓		
	1525	30						155	0.4	8.5	↓		
8-4-75	0735	-	51	100	0	0		-			7500		
	0745	10						100	0.35	7.5			
	0755	20						100	0.4	8.5	↓		
	0755	-						-			10000		
	0805	10						110	0.6	13.5			
	0815	20						110	0.6	13.5	↓		
	0815	-						-			15000		
	0825	10						126	0.65	14.5			
	0835	20						126	0.65	14.5	↓		
	0835	-						-			20000		
	0845	10						154	0.7	16			
	0855	20						156	0.7	16	↓		
	0905	30						156	0.7	16	↓		
	0905	-						-			25000		
	0915	10						178	0.6	13.5			
	0925	20						172	0.6	13.5	↓		
	0935	30						172	0.6	13.5	↓		
	0935	-						-			30000		
	0945	10						178	0.6	13.5			
	0955	20						178	0.6	13.5	↓		
	1005	30						178	0.6	13.5	↓		
8-4-75	1245	-	59	125	0	0		104	0.15	3	7500		
	1255	10						104	0.15	3	↓		
	1255	-						-			10000		
	1305	10						112	0.25	5			
	1315	20						112	0.25	5	↓		
	1315	-						-			15000		
	1325	10						140	0.35	7.5			
	1335	20						140	0.35	7.5	↓		
	1335	-						-			20000		
	1345	10						162	0.4	8.5			
	1355	20						162	0.4	8.5	↓		
	1355	-						-			25000		
	1405	10						206	0.45	10			
	1415	20						208	0.45	10	↓		
	1425	30						207	0.45	10	↓		
	1425	-						-			30000		
	1435	10						198	0.45	10			
	1445	20						209	0.45	10	↓		
	1455	30						209	0.45	10	↓		
9-4-75	0815	-	67	150	0	0		108	0.1	2	7500		
	0825	10						108	0.1	2	↓		
	0825	-						-			10000		
	0835	10						118	0.15	3			
	0845	20						118	0.15	3	↓		
	0845	-						-			15000		
	0855	10						132	0.2	4			
	0905	20						142	0.2	4	↓		
	0905	-						-			20000		
	0905	-						-					

TEST NO 18 BRG. NO 50 RETAINER WGT INT. CL 5 MILS BALL HOLE CL 13 MILS CAGE LAND CL 15 MILS GRINDS No												
TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED		REMARKS
DATE	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM	
9-4-75	0910	5	67	158	0	0		169	0.25	5	20000	
	0920	15						174	0.25	5		
	0930	25						175	0.25	5		
	0939	-						-	-	-	25000	
	0935	5						197	0.3	7		
	0945	15						206	0.3	7		
	0955	25						208	0.3	7		
	0955	-						-	-	-	30000	
	1005	10						224	0.5	11		
	1015	20						298	0.6	19.5		
Test stopped when Temperature exceeded 700°F												

TEST NO 19 BRG NO 50 RETAINER WGT INT. CL 5 MILS BALL NO 1 CL 10 MILS CAGE LAND CL 15 MILS GRINDS 10

DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP		BEARING TORQUE		SPEED	REMARKS	
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM		
10-9-75	1715	-	43	75	0	0			106	0.05	1	7500	
	1725	10							106	0.05	1	↓	
	1735	-							-	-	-	10000	
	1735	10							120	0.1	2		
	1745	20							120	0.1	2	↓	
	1745	-							-	-	-	15000	
	1755	10							146	0.3	7		
	1805	20							148	0.3	7	↓	
	1805	-							154	0.3	7	20000	
	1810	5							168	0.35	7.5		
	1815	10							176	0.35	7.5		
	1820	15							182	0.4	8.5		
	1825	20							174	0.25	5		
	1830	25							182	0.45	10	↓	
	1830	-							-	-	-	25000	
	1835	5							170	0.25	5		
	1840	10							162	0.25	5		
	1845	15							158	0.25	5		
	1850	20							162	0.25	5		
	1855	25							168	0.3	7		
	1900	30							163	0.25	5	↓	
	1900	-							-	-	-	30000	
	1905	5							197	0.3	7		
	1915	10							258	0.6	13.5		
↓	1925	20							258	0.6	13.5	↓	
11-4-75	0800	-	51	100	0	0			142	0.6	13.5	7500	
	0810	10							148	0.6	13.5	↓	
	0810	-							-	-	-	10000	
	0820	10							168	0.7	16		
	0830	20							168	0.7	16	↓	
	0830	-							-	-	-	15000	
	0840	10							182	0.7	16		
↓	0850	20											

TEST NO. 20 BRG. NO 51 RETAINER A ₁ H ₁ INT. CL 5 MILS BALL HOLE CL 1/16 MILS CAGE-LAND CL 1/16 MILS GROOVES No													
DATE	TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP.		BEARING TORQUE		SPEED	REMARKS	
	READING	RUNNING	PSI	LBS	PSI	LBS	I.R.	O.R.	READING	IN-OZ	RPM	NOISE	Q ₁
14-7-75	1300	-	51	100	0	0			170	0.2	4	4000	0
	1315	15							170	0.4	8.5		0.25
	1330	30							214	0.5	11		0.50
	1345	45							228	0.5	11		0.75
	1400	60							266	0.8	18.5		1.0
15-7-75	0800	-							200	0.2	4		
	0815	15							240	0.2	4		1.25
	0830	30							260	0.3	7		1.50
	0845	45							266	0.2	4		1.75
	0900	120							292	0.3	7		2.0
	0915	135							292	0.25	5		2.25
	0925	145							294	0.25	5		2.42
	0935	155							282	0.30	7		2.58
	0945	165							286	0.3	7		2.75
	1000	180							284	0.3	7		3.0
	1015	195							290	0.3	7		3.25
	1030	210							272	0.3	7		3.50
	1045	225							300	0.3	7		3.75
	1100	240							318	0.3	7		4.0
	1115	255							344	0.3	7		4.25
	1130	270							348	0.3	7		4.50
	1145	285							319	0.3	7		4.75
	1200	300							294	0.3	7		5.0
	1215	315							276	0.3	7		5.25
	1230	330							270	0.3	7		5.50
	1245	345							291	0.3	7		5.75
	1300	360							312	0.3	7		6.0
	1315	375							298	0.3	7		6.25
	1330	390							300	0.3	7		6.50
	1345	405							310	0.4	8.5		6.75
	1400	420							295	0.35	7.5		7.0
	1415	435							292	0.35	7.5		7.25
	1430	450							312	0.4	8.5		7.50
	1445	465							298	0.4	8.5		7.75
	1500	480							298	0.4	8.5		8.0
	1513	495							352	0.55	12		8.25
	1530	510							354	0.55	12		8.50
	0820	-							275	0.4	8.5		
	0835	525							300	0.4	8.5		8.75
	0850	540							304	0.4	8.5		9.0
	0905	555							318	0.5	11		9.25
	0920	570							322	0.45	10		9.50
	0935	585							306	0.55	12		9.75
	0950	600							310	0.55	12		10.0
	1005	615							296	0.55	12		10.25
	1020	630							290	0.55	12		10.50
	1035	645							308	0.4	8.5		10.75
	1050	660							276	0.5	11		11.0
	1105	675							314	0.6	13.5		11.25
	1120	690							290	0.55	12		11.50
	1135	705							298	0.4	8.5		11.75
	1150	720							298	0.6	13.5		12.0
	1205	735							316	0.5	11		12.25
	1220	750							312	0.6	13.5		12.50
	1235	765							322	0.55	12		12.75
	1250	780							316	0.6	13.5		13.0
	1305	795							334	0.6	13.5		13.25
	1320	810							338	0.6	13.5		13.50
	1335	825							316	0.6	13.5		13.75
	1350	840							318	0.5	11		14.0
	1405	855							322	0.5	11		14.25
	1420	870							344	0.8	19.5		14.50
	1430	880							-	-	-		14.67

TEST NO 21 BRG NO - RETAINER A _g H _g INT CL MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GROOVES NO													
TIME		AXIAL LOAD		RADIAL LOAD		BEARING TEMP		BEARING TORQUE		SPEED		REMARKS	
DATE	READING	RUNNING	PSI	LBS	PSI	LBS	I-R	O-R	READING	IN-OZ	RPM		
15-4-75	0130	-	51	100	0	0			-	-	4000		
	0745	15	↓	↓	↓	↓		390	1.0	22.5			
	0750	Test Stopped due to high Temperature & Excessive Torque and Speeds -											
TEST NO 22 BRG NO 52 RETAINER WGT INT CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GROOVES NO													
25-4-75	1305	-	51	100	0	0		312	0.8	18.5	4000		
	1320	15	↓	↓	↓	↓		420	1.4	33.0			
	Test Time - 24 minutes Ball-chamber Contact												
TEST NO 23 BRG NO 52 RETAINER WGT INT CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 15 MILS GROOVES NO													
27-4-75	1300	-	51	100	0	0		320	1.1	25.0	4000		
	1315	15	↓	↓	↓	↓		400	2.2	51.0			Belt-hold contact
TEST NO 24 BRG NO 51 RETAINER A _g H _g INT CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 20 MILS GROOVES NO													
28-4-75	0830	-	51	100	0	0		238	0.7	16	4000	0	166.0
	0845	15						306	0.8	18.5		0.25	1868.5
	0900	30						328	0.8	18.5		0.50	1868.5
	0915	45						343	0.8	18.5		0.75	1868.5
	0930	60						350	0.8	18.5		1.00	1868.5
	0945	75						358	0.8	18.5		1.25	1868.5
	1000	90						370	0.8	18.5		1.50	1868.5
	1015	105						374	0.75	18.5		1.75	1868.5
	1030	120						370	0.8	18.5		2.00	1868.5
	1045	135						372	0.8	18.5		2.25	1868.5
	1100	150						374	0.8	18.5		2.50	1868.5
	1115	165						374	0.8	18.5		2.75	1868.5
	1130	180						320	0.8	18.5		3.00	1868.5
	1145	195						322	0.75	17		3.25	1712.0
	1200	210						322	0.75	17		3.50	1712.0
	1215	225						326	0.8	18.5		3.75	1868.5
	1230	240						328	0.8	18.5		4.00	1868.5
	1245	255						328	0.8	18.5		4.25	1868.5
	1300	270						330	0.8	18.5		4.50	1868.5
	1315	285						328	0.75	17		4.75	1712.0
	1330	300						330	0.75	17		5.00	1712.0
	1345	315						328	0.7	16		5.25	1616.0
	1400	330						324	0.7	16		5.50	1616.0
	1415	345						328	0.7	16		5.75	1616.0
	1430	360						328	0.7	16		6.00	1616.0
	1445	375						326	0.65	14.0		6.25	1512.0
	1500	390						344	0.65	14.0		6.50	1512.0
	1515	405						330	0.65	14.0		6.75	1418.0
	1530	420						324	0.6	13.5		7.00	1368.5
29-4-75	0800	-						314	0.4	8.5		-	858.5
	0815	435						326	0.4	8.5		7.25	858.5
	0830	450						432	1.6	36.5		7.50	3586.5
Ribs on cage OD Matted in film on cage ID and wear tracks on outer race are chipped 60% pocket Unbalance of cage indicated.													
TEST NO 25 BRG NO 77 RETAINER A _g H _g INT CL 5 MILS BALL HOLE CL 10 MILS CAGE LAND CL 20 MILS GROOVES 3/4 IN													
1-5-75	0950	-	51	100	0	0		-	-	-	4000		
	1005	15	↓	↓	↓	↓		430	1.6	36.5			
	Heavy rub on cage OD Cage unbalance indicated.												